Flow Planner Help

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1 Proplanner FlowPlanner

Help Version 2.0

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3 Introduction

The Flow Planner (FP) is an application used by industrial and manufacturing engineers to evaluate material flow in industrial facilities in order to identify and reduce the waste associated with materials handling. The FP diagrams, charts and computes detailed flow information within specific layers in an AutoCAD layout drawing. Flow diagrams can be generated in a straight-line or aisle-path route and can be aggregated according to trip frequency in many different ways (called aggregations).

The FP is tightly integrated with the AutoCAD application. As such, two versions of the FP exist (stand-alone and add-on). These two FP versions are identical in functionality, except that the stand-alone version incorporates the AutoCAD engine inside of the application. The AutoCAD engine provided with the stand-alone application does not have all of the features of the full AutoCAD license and is more similar to that of the AutoCAD LT license. The add-on version links to a user-provided AutoCAD license and essentially enhances that license with the capabilities provided by the FP.

The FP application requires a license code (provided by your Proplanner sales person) in order to operate fully. Without the license code, the FP will default into Evaluation mode whereby only the **Hydra Pumps.csv** input routing files will be accepted.

To use the FP add-on application you must have a version of AutoCAD, ADT, or Mechanical Desktop (Supported versions of these are found in the README.TXT file located on the installation CD) loaded on your computer, and you must provide the serial number of this application to your Proplanner sales representative in order to get your FP license code.

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4 Getting Started

Getting Started - Starting from Scratch

When starting from scratch, it is best to first start by loading a drawing of your factory and preparing it for analysis.

Preparing the drawing

The FP can work in either Engineering (Foot-Inch) or Decimal (Metric) units. By default, the application will assume that if your drawing is set to Engineering units (Done with the Units command in AutoCAD) that your base unit is 1 inch in size. If your drawing is set to Decimal units, then Proplanner will assume that your base drawing unit is 1 millimeter. Once the FP is running, you can reset your default base units (to either Inches, Millimeters or Meters) if these defaults are incorrect.

AutoCAD Note: Remember that if you use the AutoCAD UNITS command to change your drawing units, that you will also probably need to set your drawing limits (size) by using the AutoCAD LIMITS command. You will then need to follow the limits command with the ZOOM ALL command in order to ensure that you are viewing the entire work area.

Since the FP reads the distance from your drawing, it is important that the drawing is created in actual size. This means that if the distance between a table and a box is 3'6" in the real world then the drawing needs to be created such that the table is 42 base units from the box (in foot-inch units of course).

The drawing does not need to be highly detailed for the FP to work. Essentially, the drawing needs to contain enough detail that the FP user can determine where locations specified in the operator routing would be located within the workplace.

Preparing the routing

The flow routings can be defined in another application (such as MS Excel) and imported into the FP, or the routings can be defined within the FP application. If you wish to create your routing file in MS Excel, it is best to first import the sample ***Hydra Pump.csv*** file into Excel and modify it in an effort to ensure that the file format is correct. Documentation on the format of each field in this file can be found in the appendix of this manual. You may also define a flow routing within the FP by Adding and Inserting lines within the routing editor.

Conducting the analysis

Now that your drawing is drawn to actual scale and your routing has been created,

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you are ready to select the Calc command on the main routings window. Calc will create your locations, methods, method types, and container for you and will also ensure that all locations (From and To) specified in the routings are actually located within your drawing. If any routing locations are missing, the FP will prompt you to locate those within the drawing. Once all of the locations have been specified, the FP will update the Paths listing with the computed times and distance, and then will compute the summary distance, time and travel information in the results window and on the Utilization and Ergonomics Charts.

Selecting the “Save As” button will save your results out to a file. The routing data, method/processes/containers data, products/parts data and results data are all stored in separate files. These files are all simple comma-delimited text files that are easy to import into a word processor or spreadsheet.

You may right click in the list windows or on the chart to copy the information to other applications such as Word, Excel and PowerPoint. Future versions of the FP will have advanced reporting capabilities.

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4.3 Conducting the analysis

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5 Reference Section

This section explains in detail the functioning of each tab control associated with Flow Planner.

Aggregation Methods
Calculation Formulas
Routings Tab
Products tab
Locations Tab
Paths Tab
Methods Tab
Processes Tab
Containers Tab
Filter Tab
Frequency/Congestion Tab
Utilization Tab
Ergonomics Tab
Reports Tab
Licensing/Settings Tab

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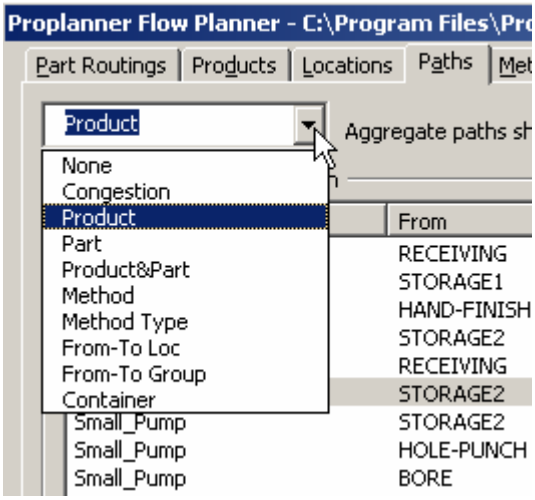
5.1 Aggregation Methods

The FP application allows you to generate flow diagrams with frequency (line width) summaries using 9 different aggregation (grouping) methods. Each of these aggregations can be generated with the Calc command, and once created, can be viewed in the Paths tab by selecting the aggregation name from the top-left pull-down list box. Once the paths are generated by the calc command, their frequency, distance, origin, destination, and method properties are encoded within the poylines in AutoCAD. As such, you can run the FP in subsequent sessions and view, query, filter, scale and color-code these paths without needing to reload the routings file and recalculating the analysis.



None– No aggregation is used.

Congestion – Aggregates all flows between each aisle network node (every aisle path segment). Color is assigned in the Frequency/Congestion tab.

Product – Aggregates all flows between a From and To (or Via) location for all part routings within a product. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each product shown. Color is assigned to each unique Product in the Products/Parts tab.

Part – Aggregates all flows between a From and To (or Via) location for all unique Parts routings within all products. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each a uniquely named Part regardless of the product it is under. Color is assigned to each unique Part by the Part color in the Products/Parts tab. If the same part name is found under multiple products, then the color for the last referenced part name is used.

Product&Part– Aggregates all flows between a From and To (or Via) location for all unique Parts routings within each Product. Thus the frequency of flow From a Location to another Location represents all of the part flows between

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those locations for each unique Part in each unique Product. Colors are assigned to each unique Product&Part pair by the Part color in the Products/Parts tab.

Method – Aggregates all flows between a From and To (or Via) location for all part routings that reference a unique move Method. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each unique Method used between those locations. Colors are assigned to each unique method in the Methods tab.

Method Type – Aggregates all flows between a From and To (or Via) location for all part routings that reference a unique move Method Type. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each unique Method Type used between those locations. Colors are assigned to each unique method type in the Methods tab.

From-To Loc – Aggregates all flows between a From and To (or Via) location for all part routings. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for all parts, products, methods, method types and containers. Colors are assigned to each unique From-To Location pair based upon the color assigned to the Group that is referenced by the From location in the Locations tab.

From-To Group – Aggregates all flows between a From and To (or Via) location for all part routings within a product. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each product shown. Colors are assigned to each unique From-To Group pair based upon the color assigned to the From Group in the Locations tab.

Container – Aggregates all flows between a From and To (or Via) location for all part routings that reference each unique container. Thus the frequency of flow From a Location to another Location represents all of the part flows between those locations for each container type moved between those locations. Color is assigned to each unique Container in the Containers tab.

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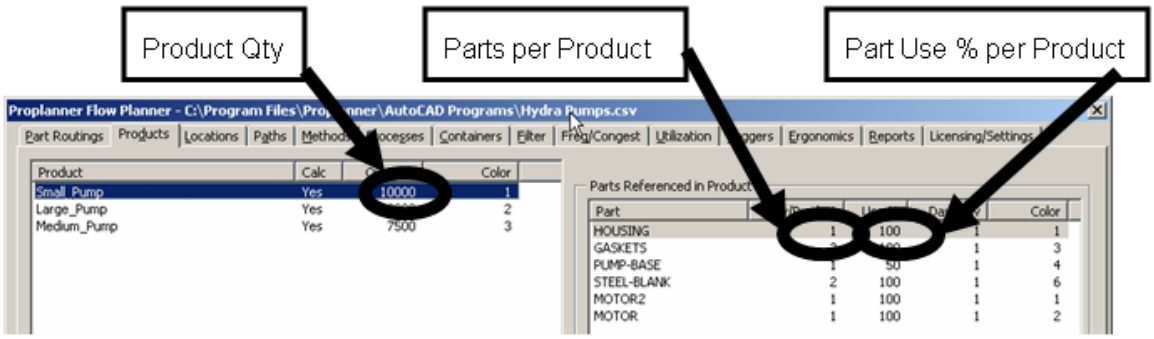
5.2 Calculation Formulas

The FP Application calculates flow frequency in number of trips between any two locations on a route-by-route basis. These route frequencies are then aggregated (by the user-selected aggregation method) and used to scale the thickness of the flow lines between every pair of locations, groups or nodes as appropriate to the aggregation method.

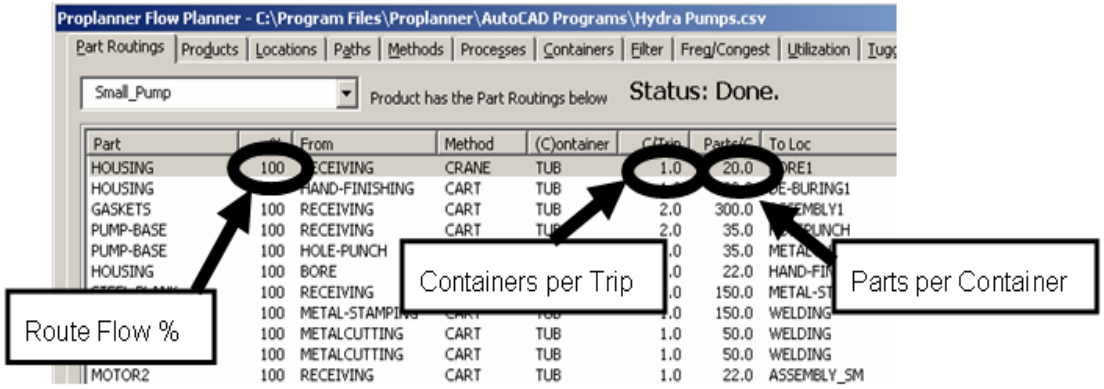
FP then computes the distance of each flow path and evaluates the speed of the method assigned to that path, along with that method's load and unload time and acceleration/deceleration. From these properties, Proplanner determines the time required (as well as the travel percentage of that total trip time) and multiplies this time by the variable cost of the method to arrive at the route's travel cost.

Route Frequency Calculation

Products Tab (below)



Part Routings Tab (below)



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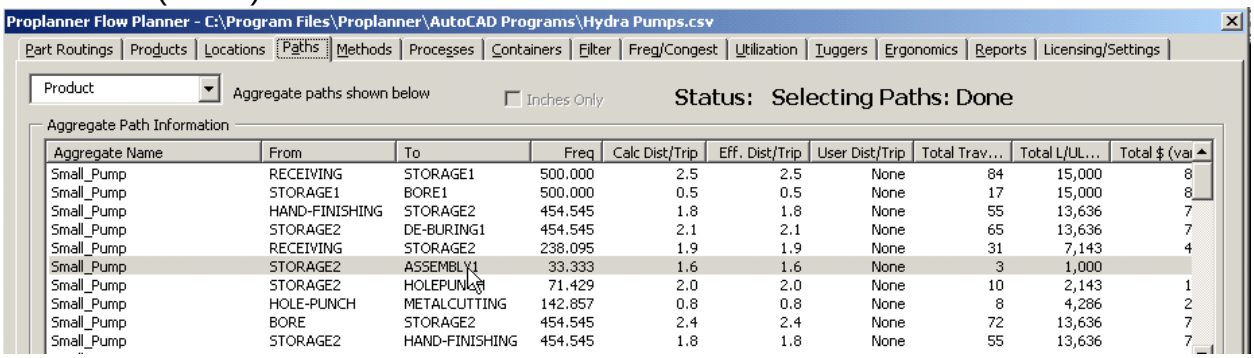
Route Frequency Parameters

- RF - Route Frequency
- PQ - Product Quantity
- PPP - Parts Per Product
- PU - Part Use %
- PF - Route Flow %
- CPT - Containers Per Trip
- PPC - Parts Per Container

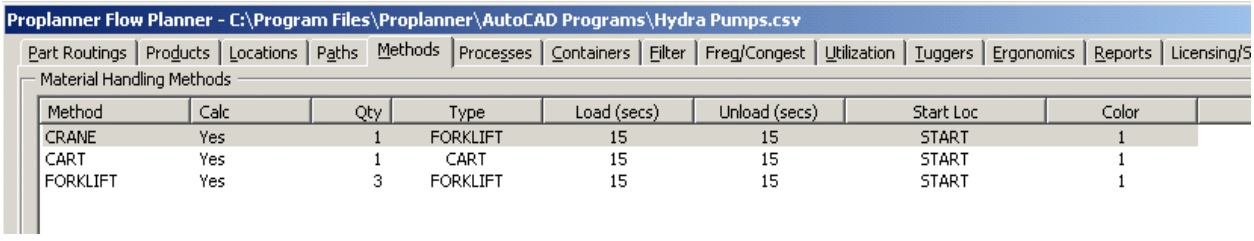
RF = (PQ * PPP * PU * PF) / (CPT * PPC)

Method Distance, Time and Cost Calculation

Paths Tab (below)


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL...
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636

Methods Tab – Methods List (below)


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/S
Material Handling Methods
Method | Calc | Qty | Type | Load (secs) | Unload (secs) | Start Loc | Color
CRANE | Yes | 1 | FORKLIFT | 15 | 15 | START | 1
CART | Yes | 1 | CART | 15 | 15 | START | 1
FORKLIFT | Yes | 3 | FORKLIFT | 15 | 15 | START | 1

Methods Tab - Method Types List (below)

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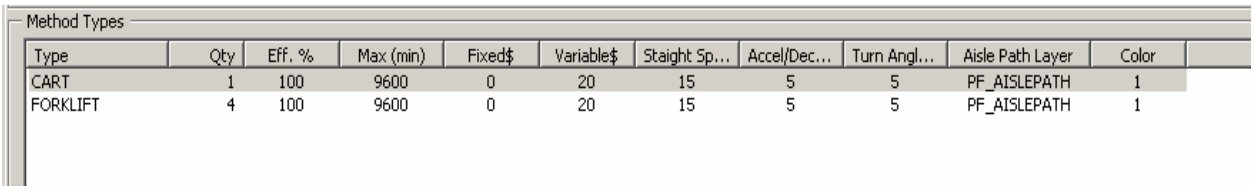
Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
FORKLIFT	4	100	9600	0	20	15	5	5	PF_AISLEPATH	1

Method Distance, Time and Cost Parameters

- LT – Load Time
- UT – Unload Time
- Q – Quantity of Method Type
- EF – Effective %
- MM – Maximum Minutes Available per time period
- FC – Fixed Cost per Method Type
- VC – Variable Cost per Hour
- D – Path Distance (Calculated from ACAD unless a user specified dist exists)
- T – Total Path time (Travel plus Load plus Unload)
- SS – Straight Speed
- TS – Turn Speed
- TA – Turn Angle
- TT – Path Travel Time
- TC – Total Method Type Cost
- TM – Total Method Type Minutes

(Simplified version without Accel/Decel) TT = (D / EF) / SS

T = TT+UT+LT

Q = Round Up(TM / MM)

TC = (FC * Q) + Paths Summation(T) * VC

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5.2.1 Route Frequency Calculation

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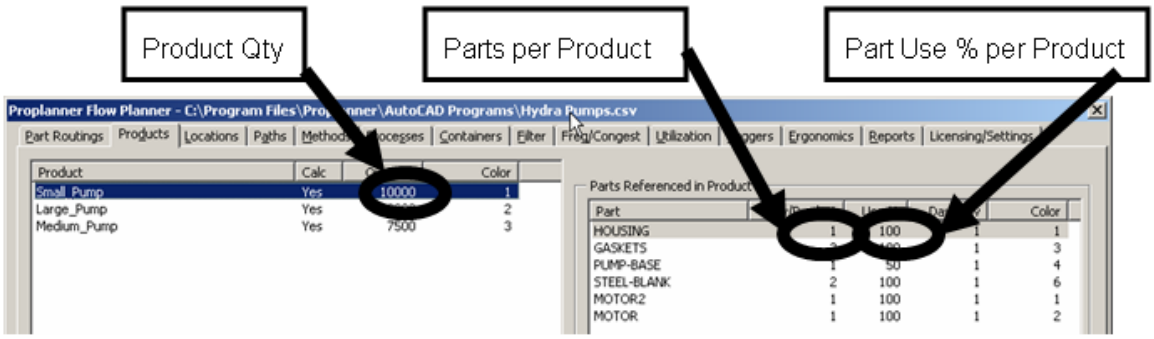
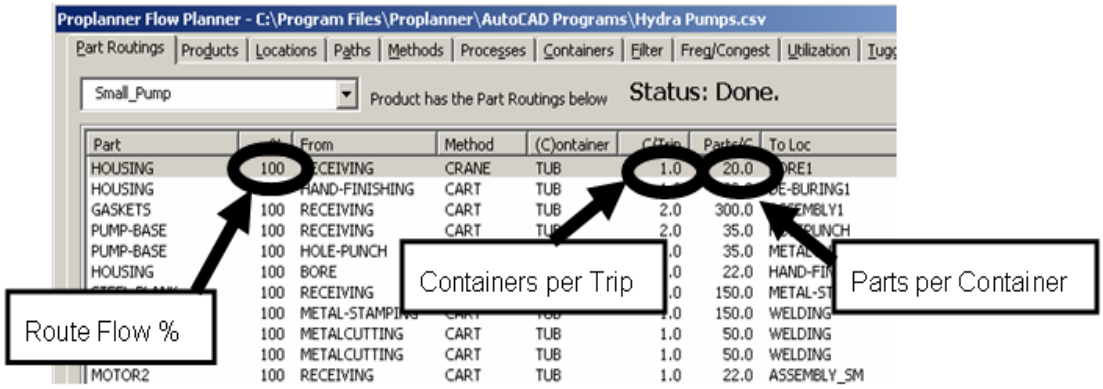


Part Routings Tab (below)



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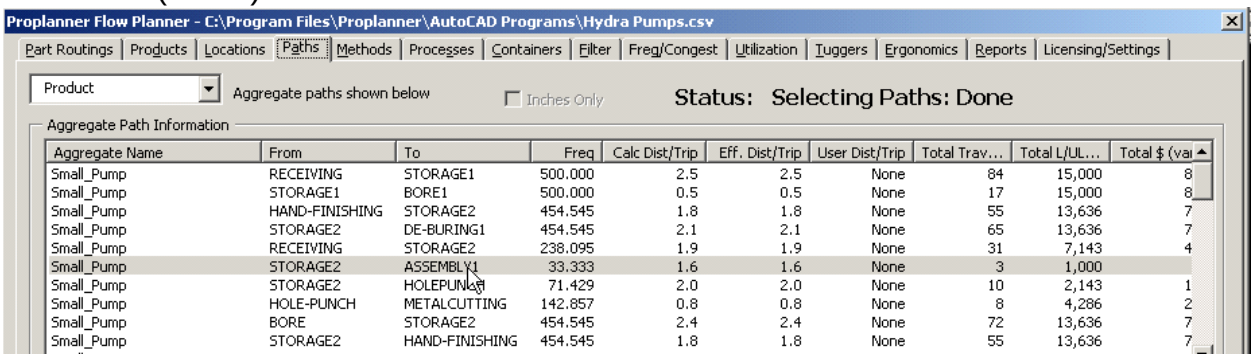
Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL...
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000
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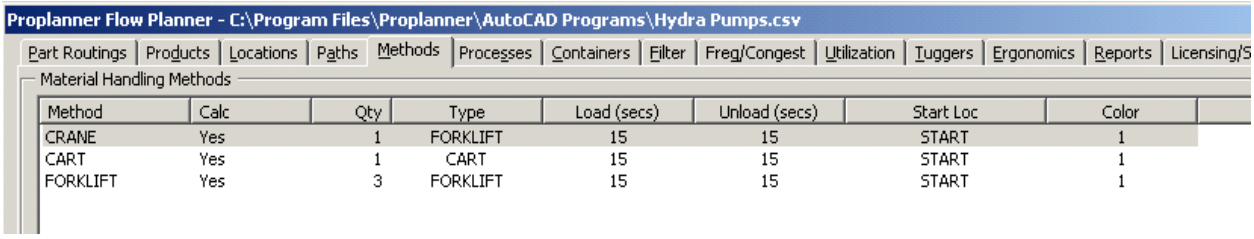
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636

Methods Tab – Methods List (below)


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/S
Material Handling Methods
Method | Calc | Qty | Type | Load (secs) | Unload (secs) | Start Loc | Color
CRANE | Yes | 1 | FORKLIFT | 15 | 15 | START | 1
CART | Yes | 1 | CART | 15 | 15 | START | 1
FORKLIFT | Yes | 3 | FORKLIFT | 15 | 15 | START | 1

Methods Tab - Method Types List (below)

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Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
FORKLIFT	4	100	9600	0	20	15	5	5	PF_AISLEPATH	1

Method Distance, Time and Cost Parameters

- LT – Load Time
- UT – Unload Time
- Q – Quantity of Method Type
- EF – Effective %
- MM – Maximum Minutes Available per time period
- FC – Fixed Cost per Method Type
- VC – Variable Cost per Hour
- D – Path Distance (Calculated from ACAD unless a user specified dist exists)
- T – Total Path time (Travel plus Load plus Unload)
- SS – Straight Speed
- TS – Turn Speed
- TA – Turn Angle
- TT – Path Travel Time
- TC – Total Method Type Cost
- TM – Total Method Type Minutes

(Simplified version without Accel/Decel) TT = (D / EF) / SS

T = TT+UT+LT

Q = Round Up(TM / MM)

TC = (FC * Q) + Paths Summation(T) * VC

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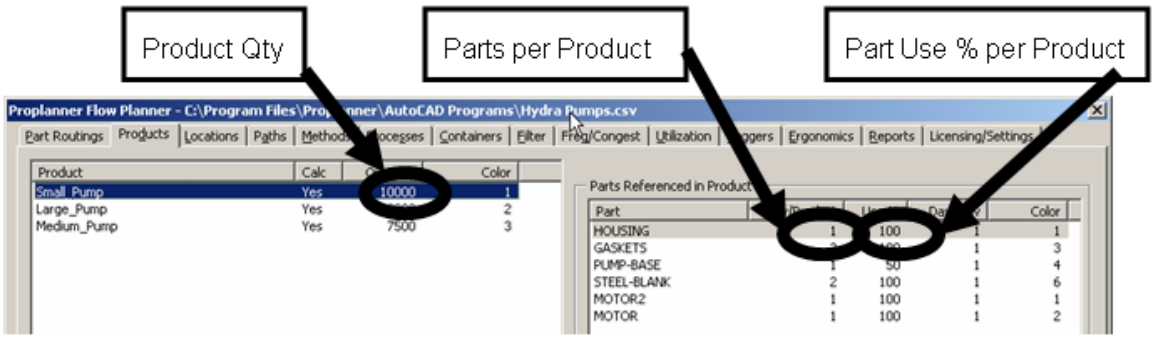
5.2.2 Method Distance, Time and Cost Calculation

The FP Application calculates flow frequency in number of trips between any two locations on a route-by-route basis. These route frequencies are then aggregated (by the user-selected aggregation method) and used to scale the thickness of the flow lines between every pair of locations, groups or nodes as appropriate to the aggregation method.

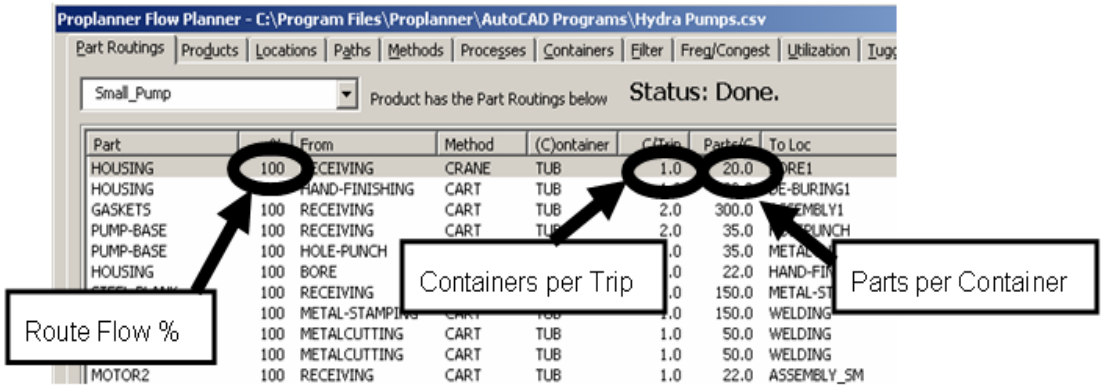
FP then computes the distance of each flow path and evaluates the speed of the method assigned to that path, along with that method's load and unload time and acceleration/deceleration. From these properties, Proplanner determines the time required (as well as the travel percentage of that total trip time) and multiplies this time by the variable cost of the method to arrive at the route's travel cost.

Route Frequency Calculation

Products Tab (below)



Part Routings Tab (below)



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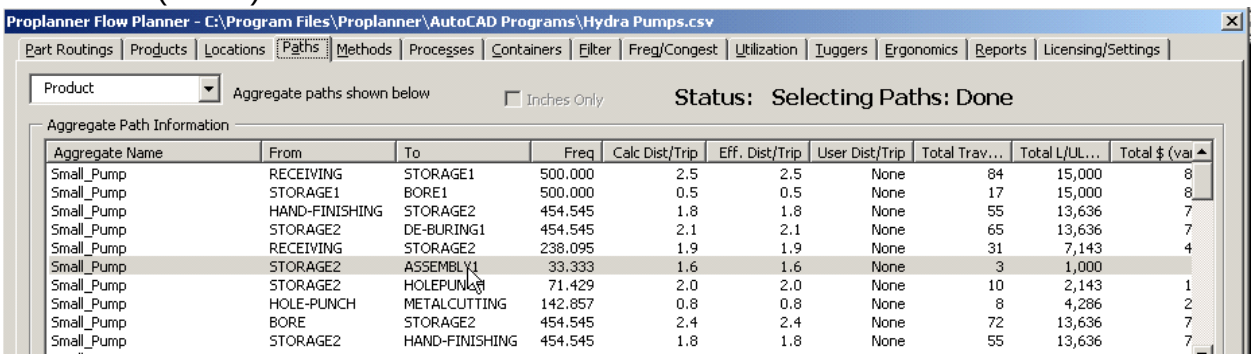
Route Frequency Parameters

- RF - Route Frequency
- PQ - Product Quantity
- PPP - Parts Per Product
- PU - Part Use %
- PF - Route Flow %
- CPT - Containers Per Trip
- PPC - Parts Per Container

RF = (PQ * PPP * PU * PF) / (CPT * PPC)

Method Distance, Time and Cost Calculation

Paths Tab (below)


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL...
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
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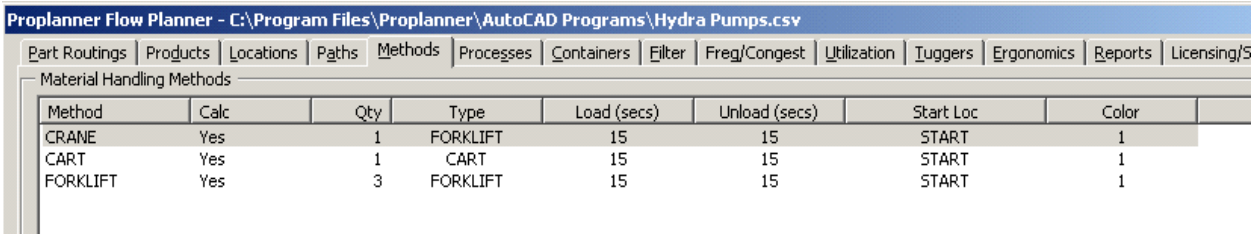
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636

Methods Tab – Methods List (below)


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/S
Material Handling Methods
Method | Calc | Qty | Type | Load (secs) | Unload (secs) | Start Loc | Color
CRANE | Yes | 1 | FORKLIFT | 15 | 15 | START | 1
CART | Yes | 1 | CART | 15 | 15 | START | 1
FORKLIFT | Yes | 3 | FORKLIFT | 15 | 15 | START | 1

Methods Tab - Method Types List (below)

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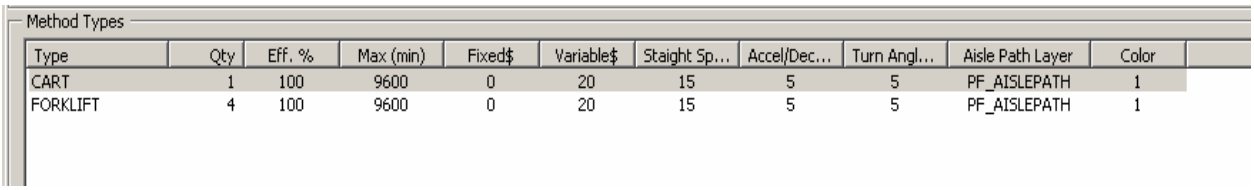
Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
FORKLIFT	4	100	9600	0	20	15	5	5	PF_AISLEPATH	1

Method Distance, Time and Cost Parameters

- LT – Load Time
- UT – Unload Time
- Q – Quantity of Method Type
- EF – Effective %
- MM – Maximum Minutes Available per time period
- FC – Fixed Cost per Method Type
- VC – Variable Cost per Hour
- D – Path Distance (Calculated from ACAD unless a user specified dist exists)
- T – Total Path time (Travel plus Load plus Unload)
- SS – Straight Speed
- TS – Turn Speed
- TA – Turn Angle
- TT – Path Travel Time
- TC – Total Method Type Cost
- TM – Total Method Type Minutes

(Simplified version without Accel/Decel) TT = (D / EF) / SS

T = TT+UT+LT

Q = Round Up(TM / MM)

TC = (FC * Q) + Paths Summation(T) * VC

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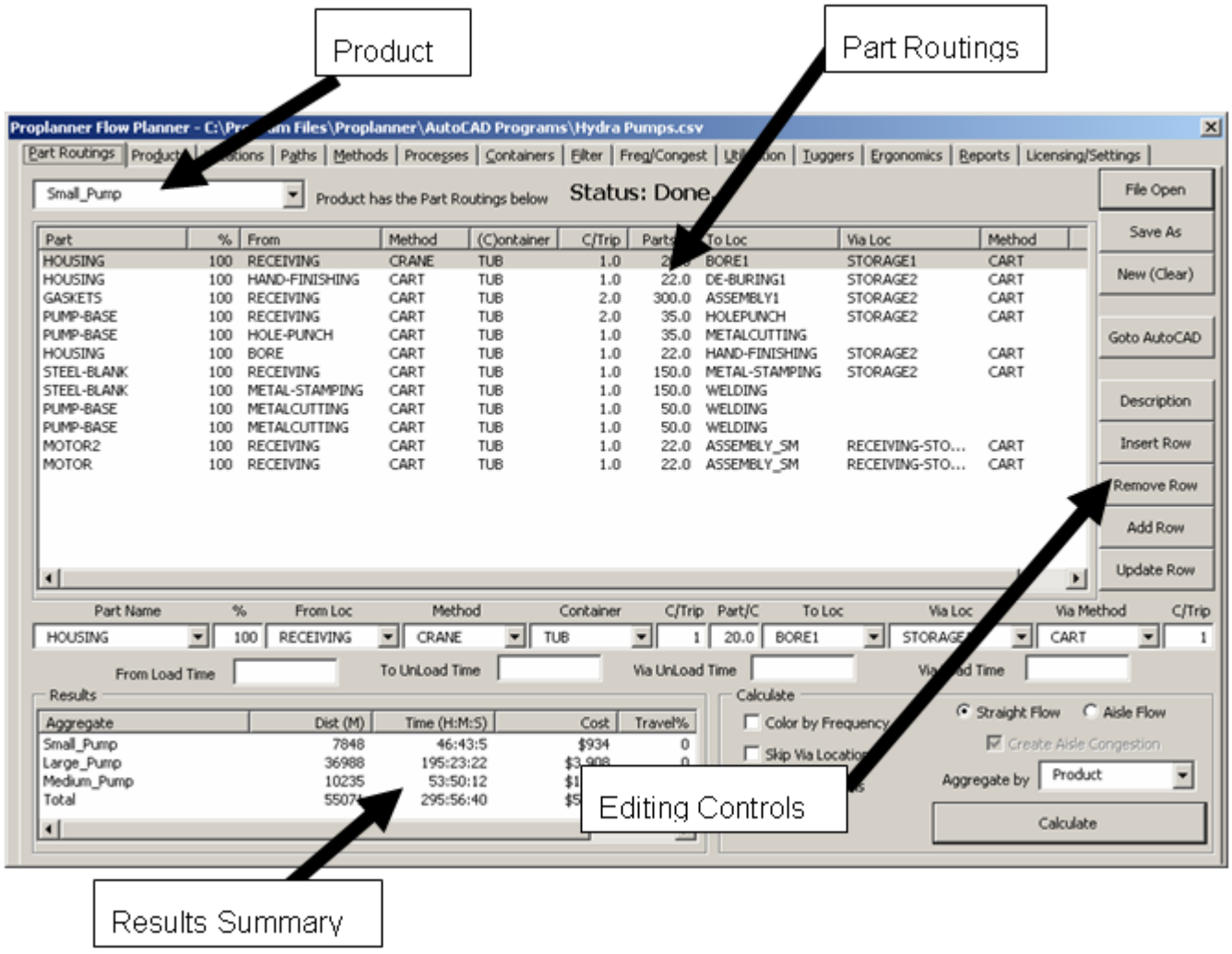
5.3 Routings Tab



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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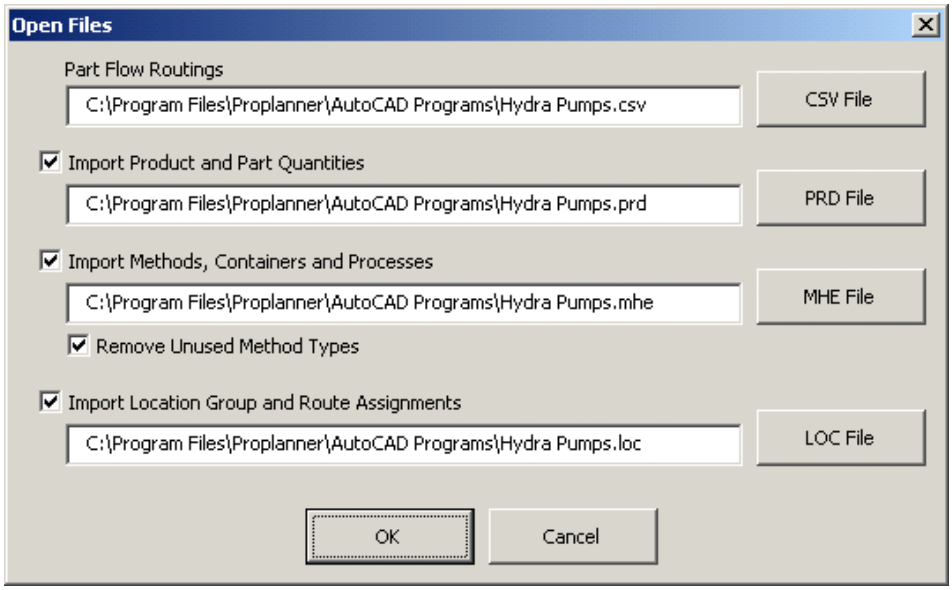
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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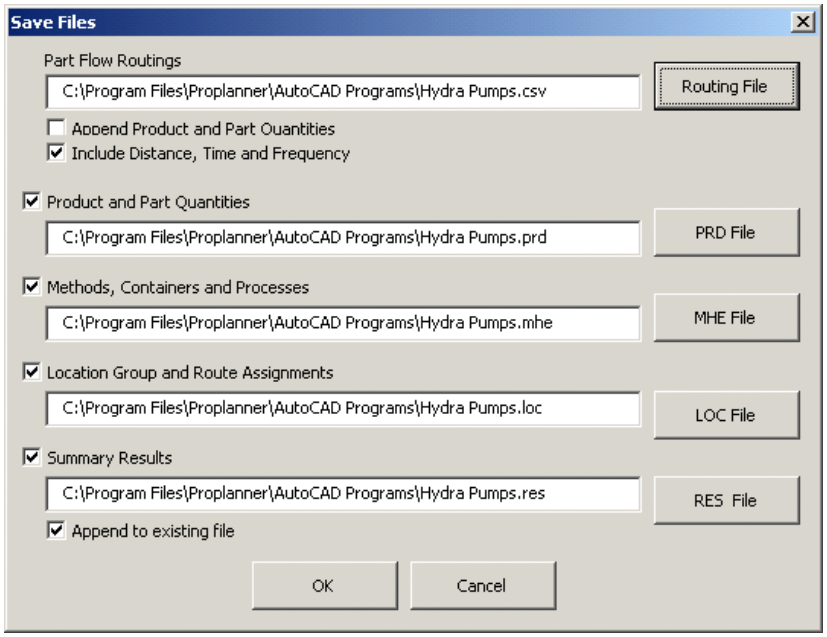
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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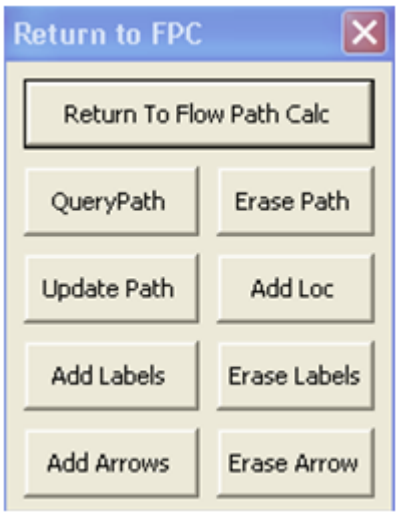
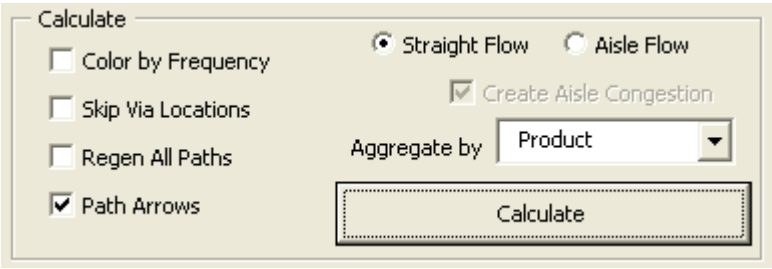


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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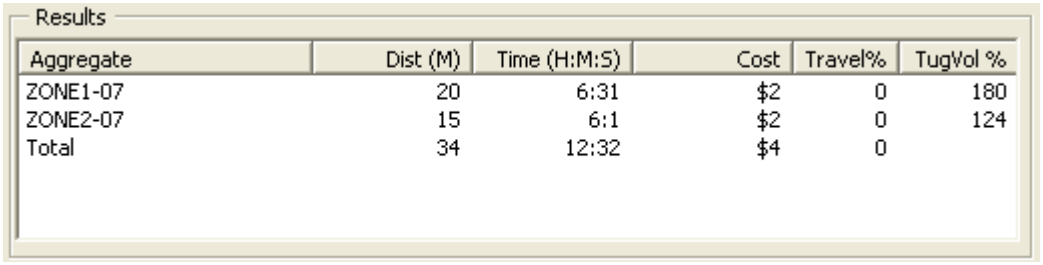
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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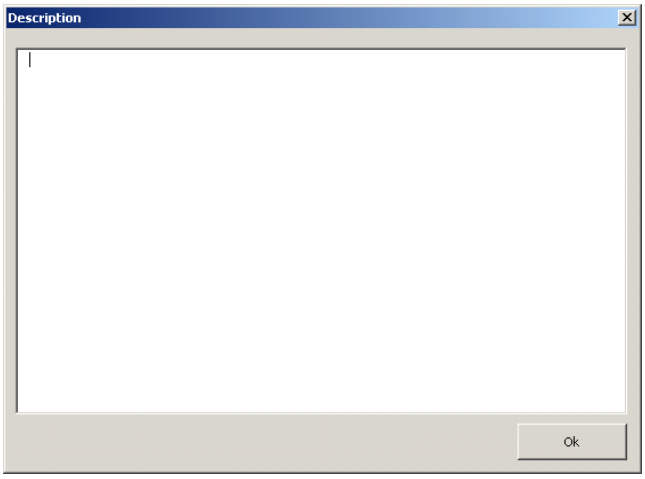
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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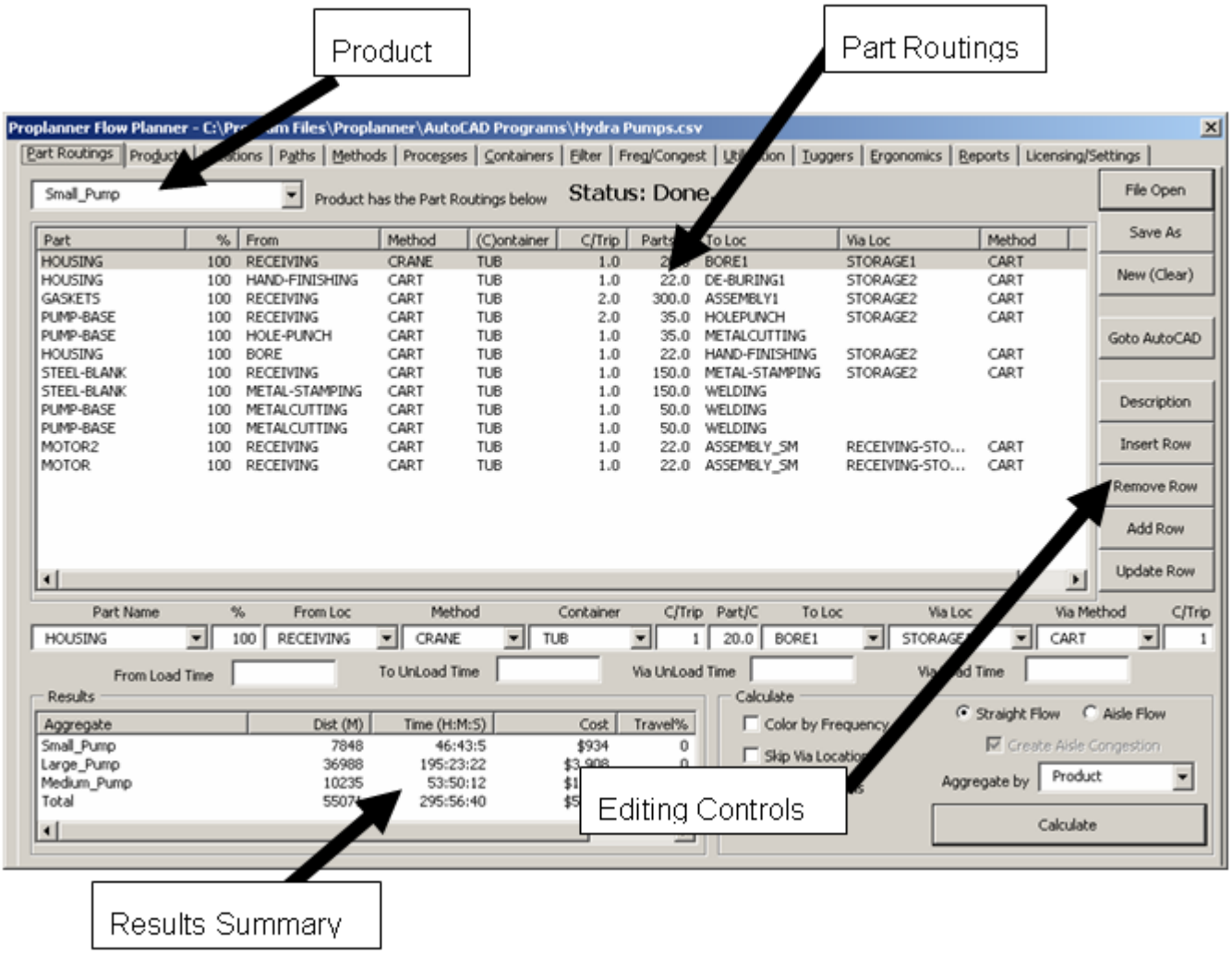
5.3.1 Main Controls



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Main Controls

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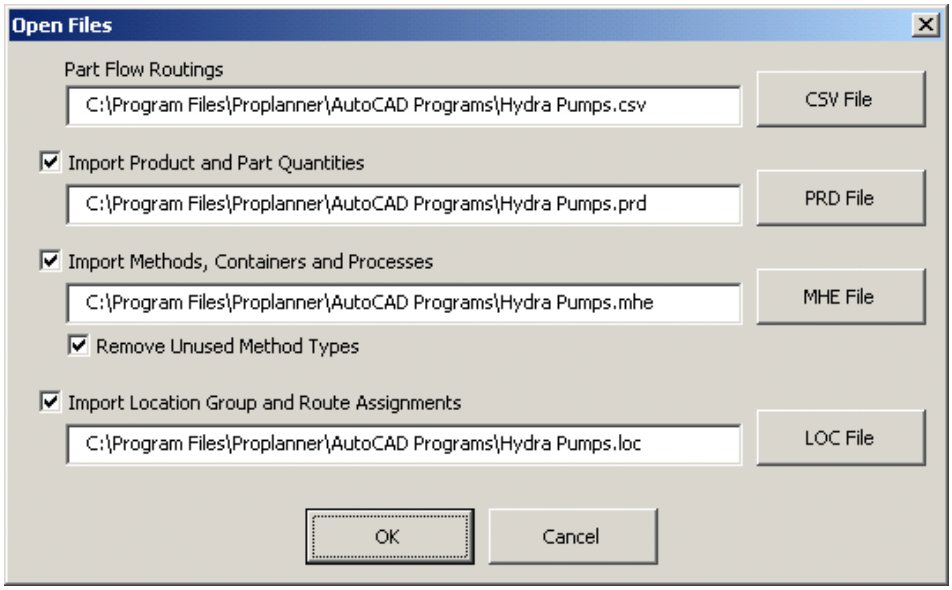

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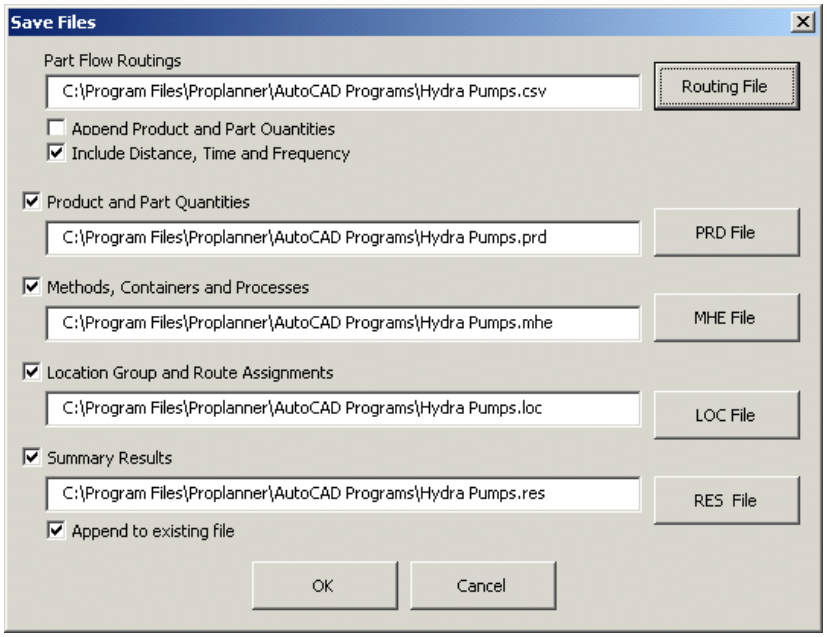
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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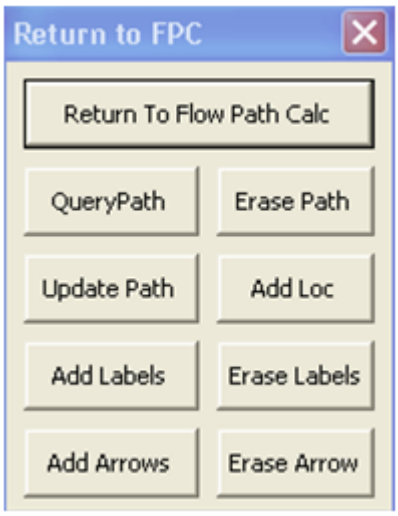
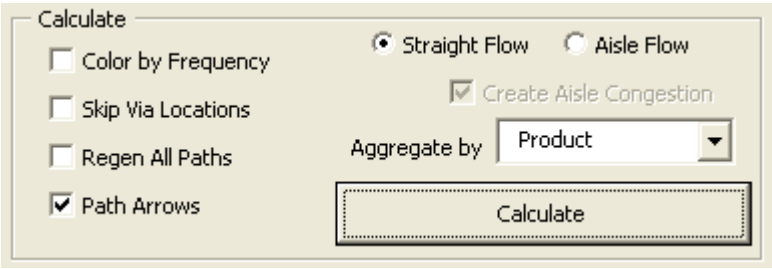


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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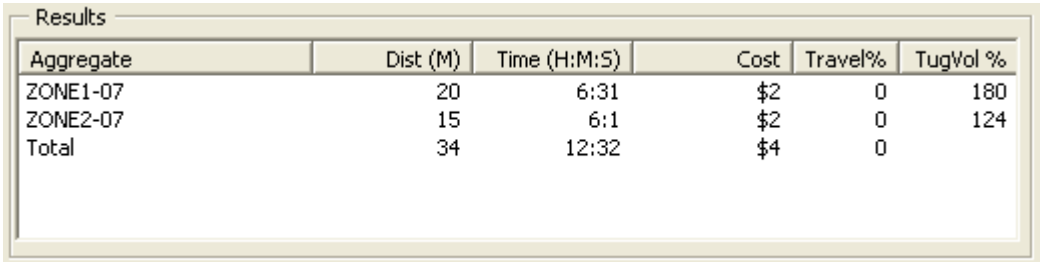
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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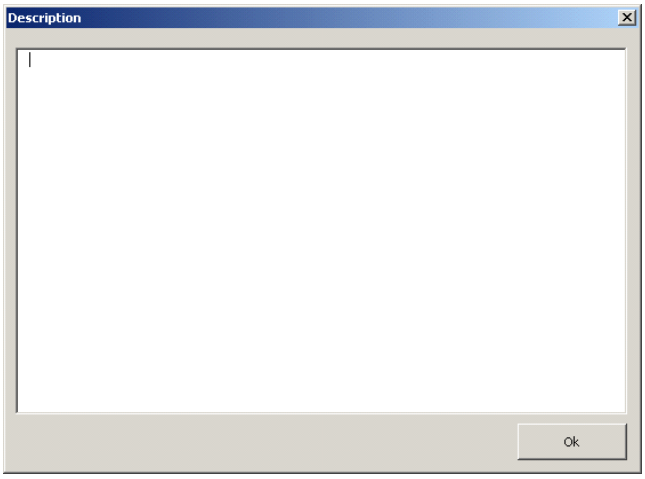
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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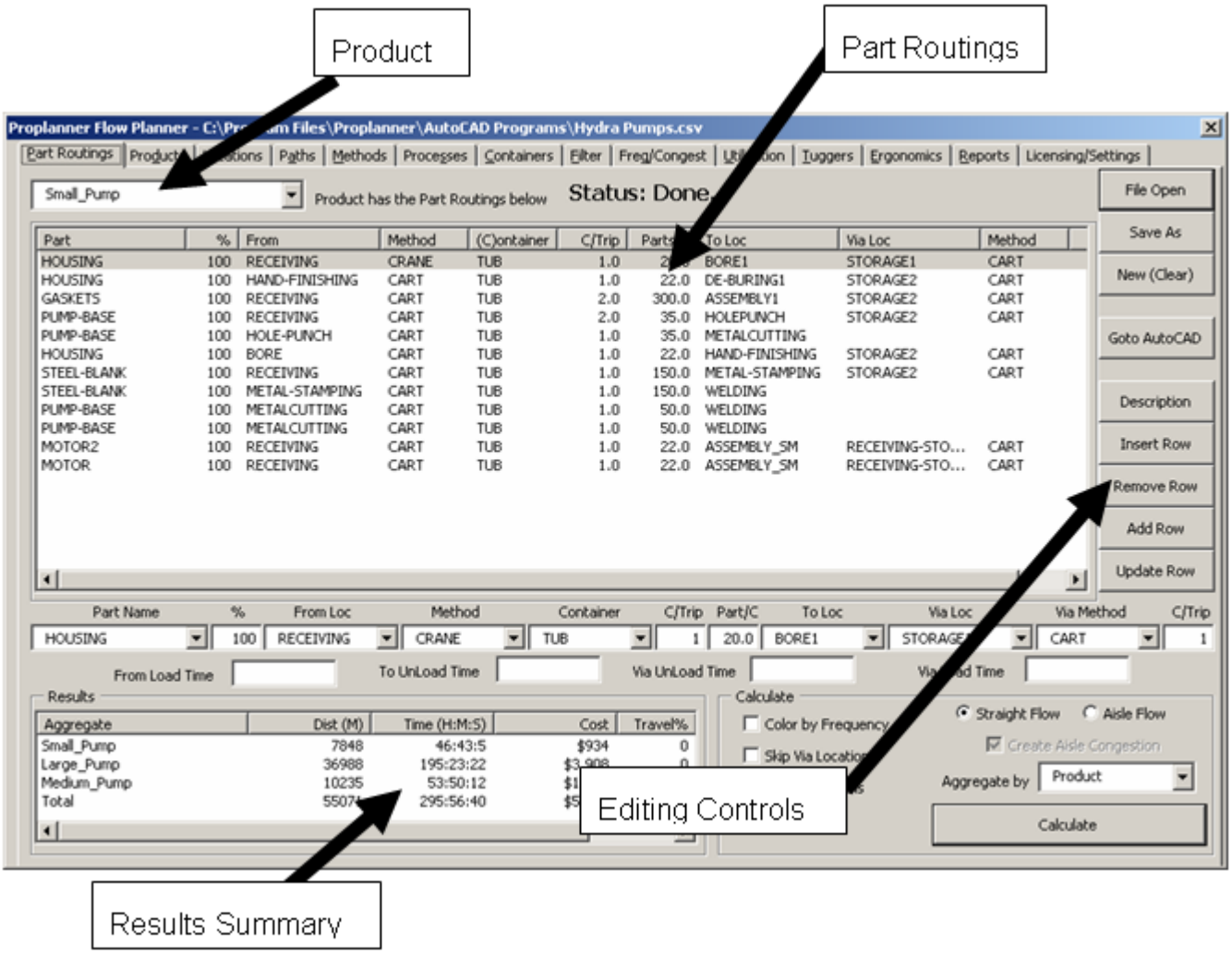
5.3.2 Calculate



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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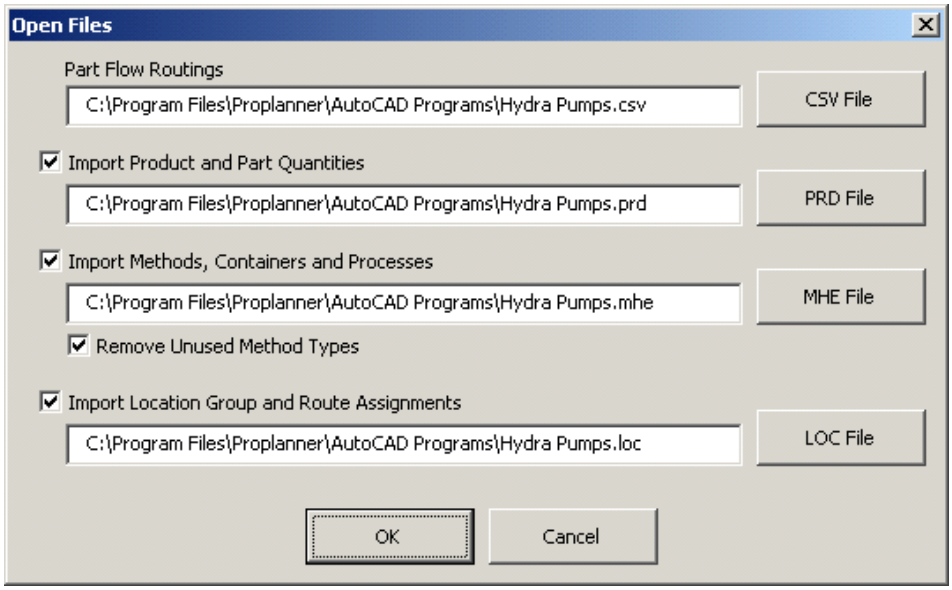
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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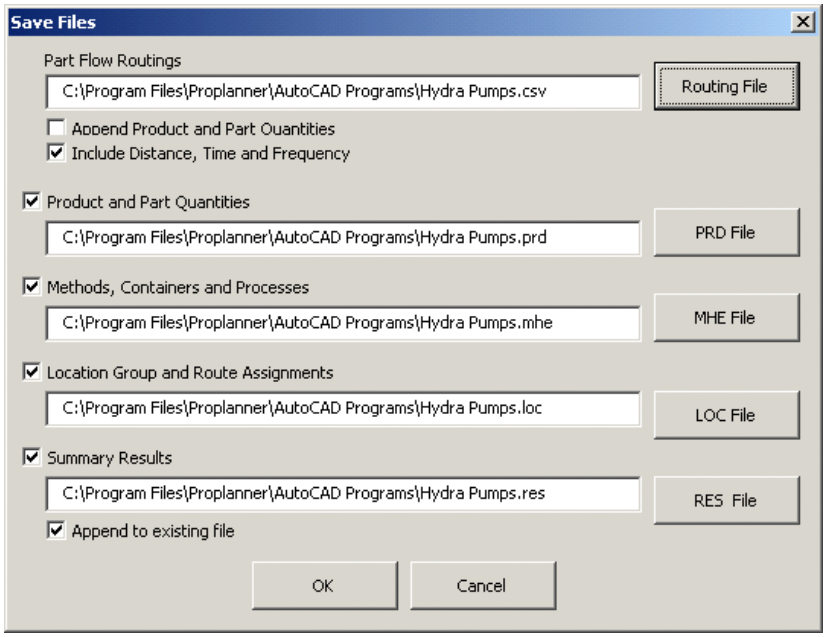
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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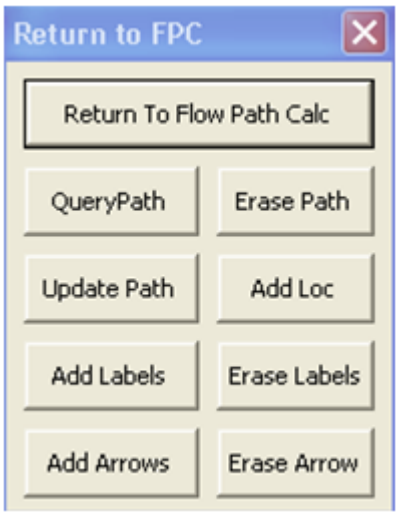
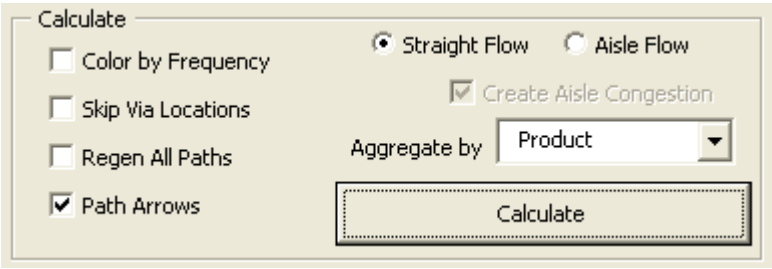


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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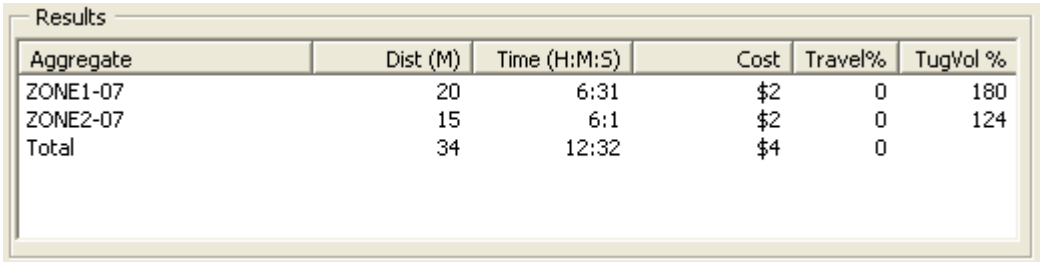
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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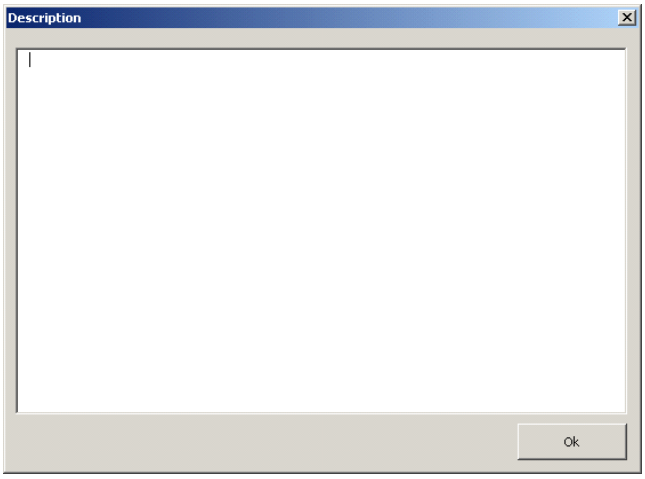
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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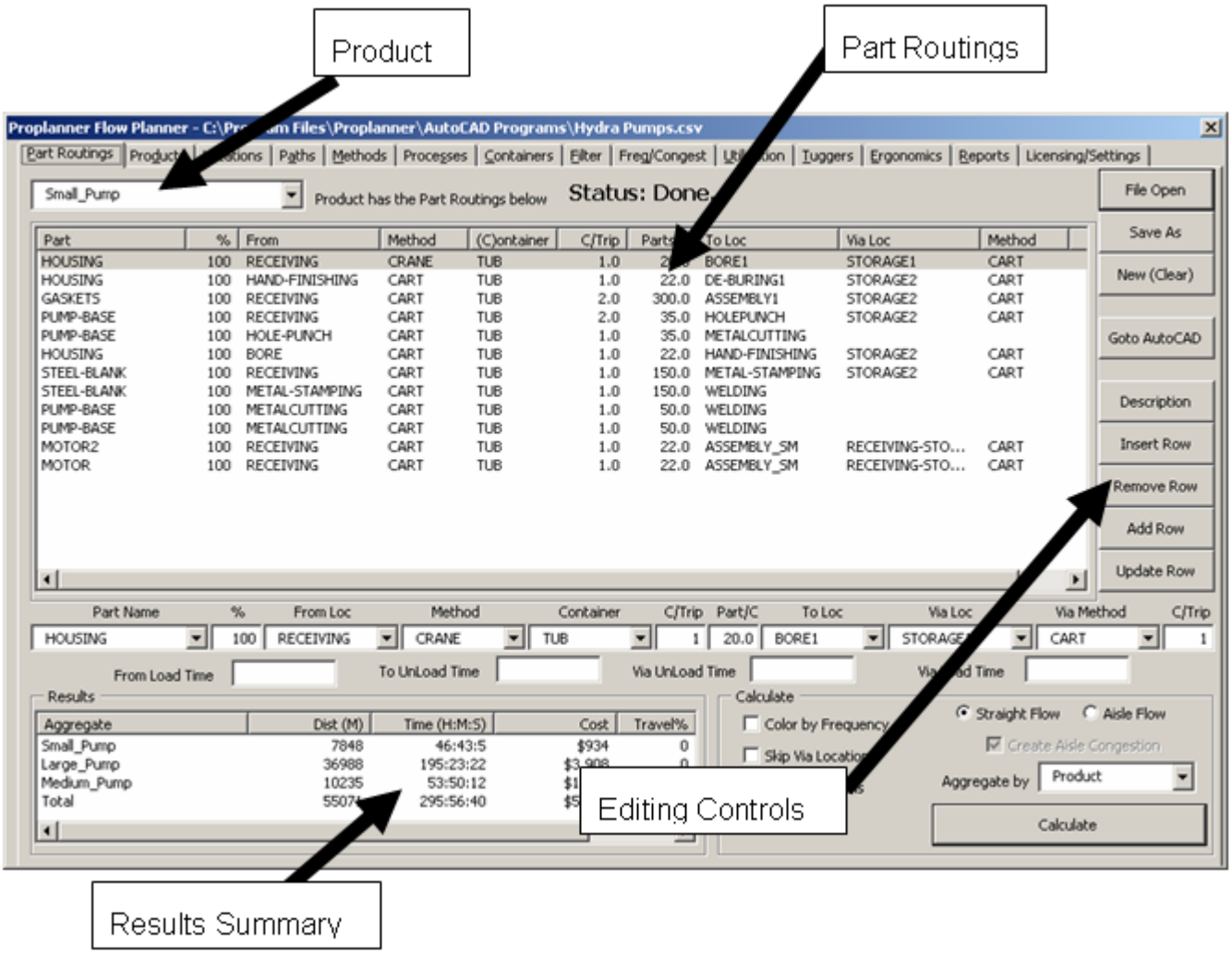
5.3.3 Results



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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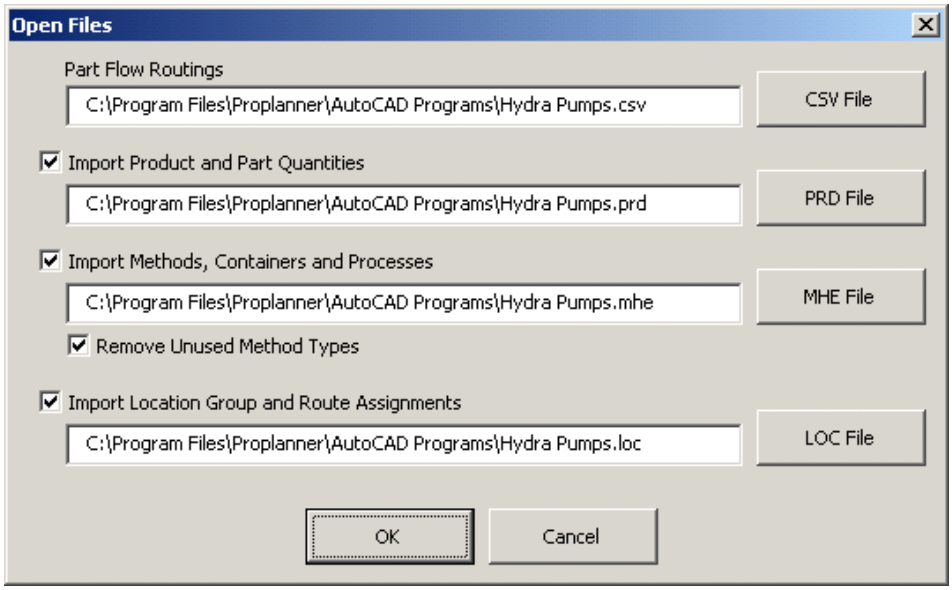
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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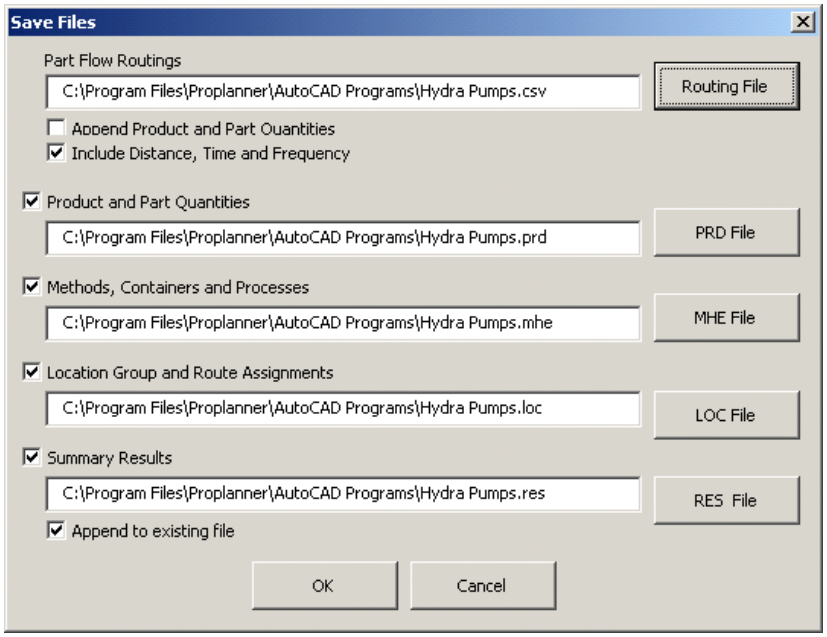
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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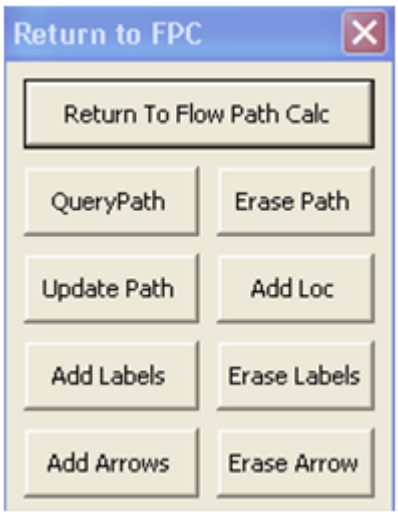
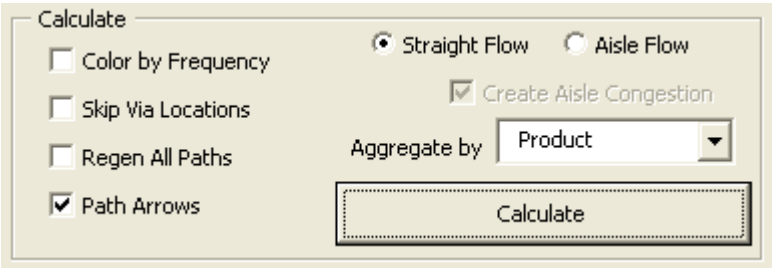


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the "Regen all Paths" option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the "Freq/Congest" tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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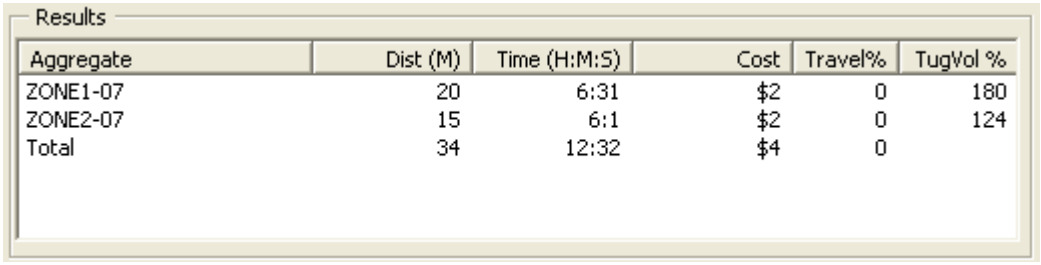
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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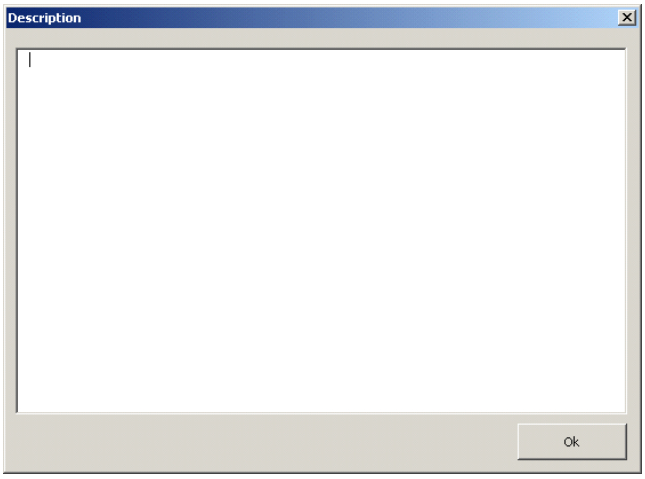
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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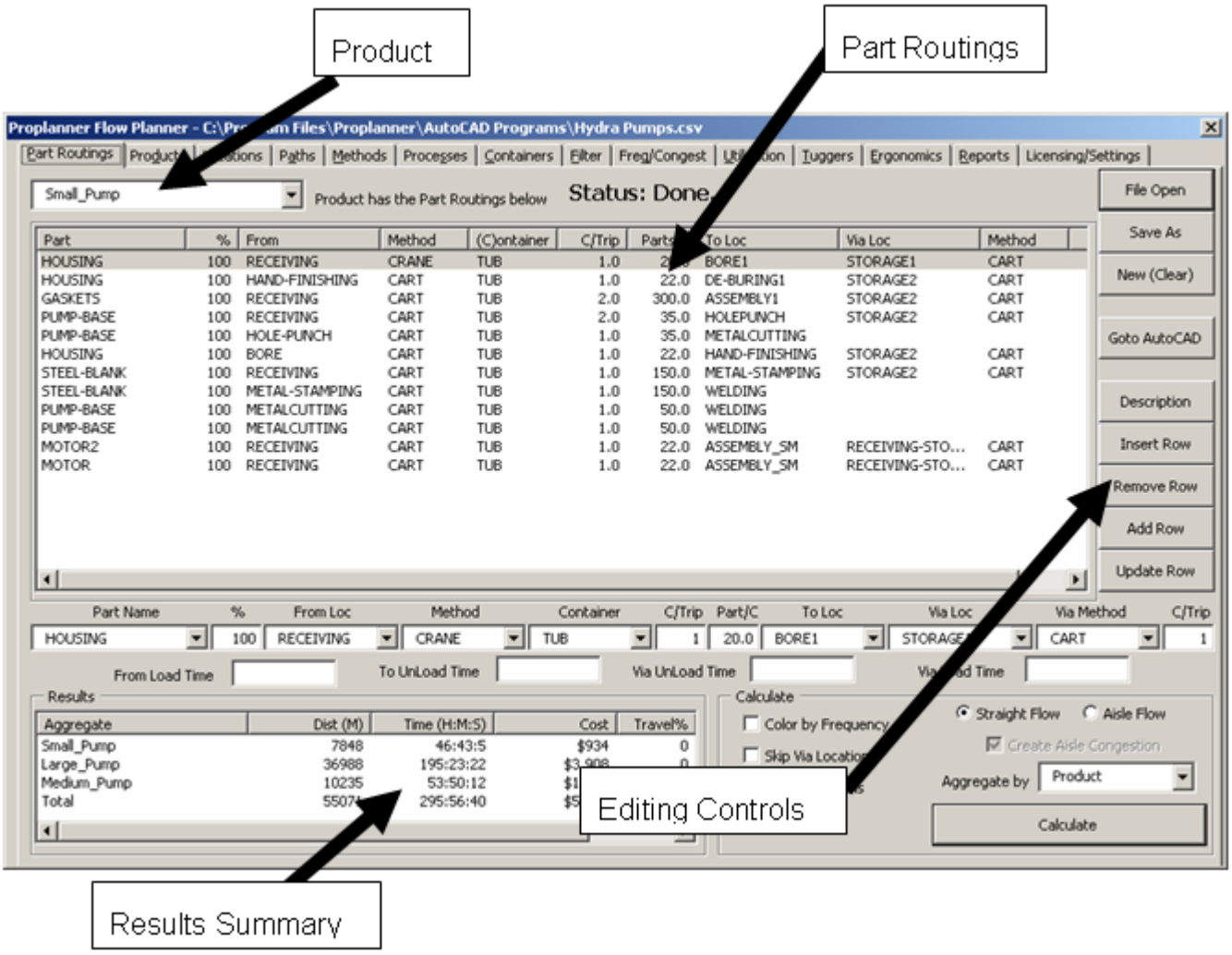
5.3.4 Routing Editor Controls



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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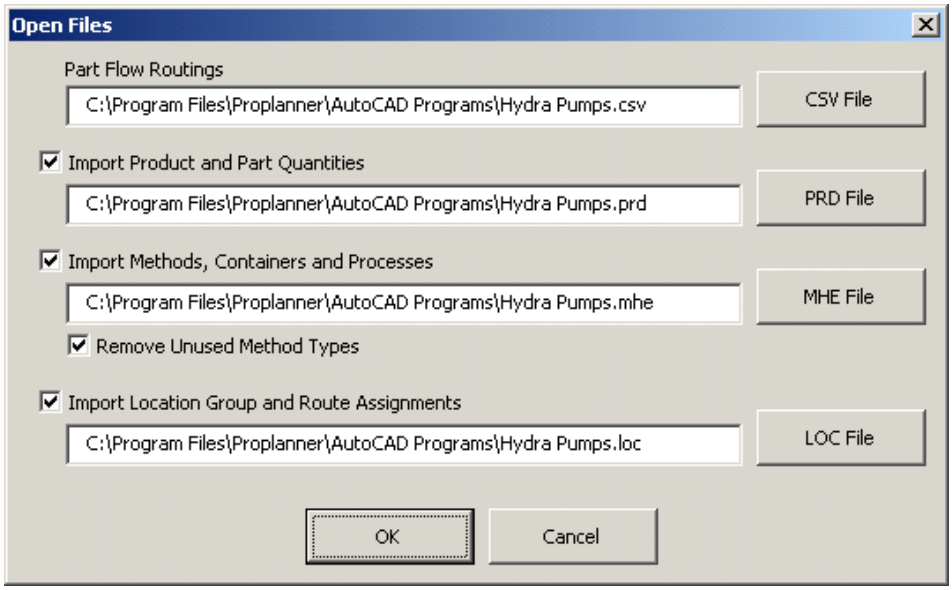
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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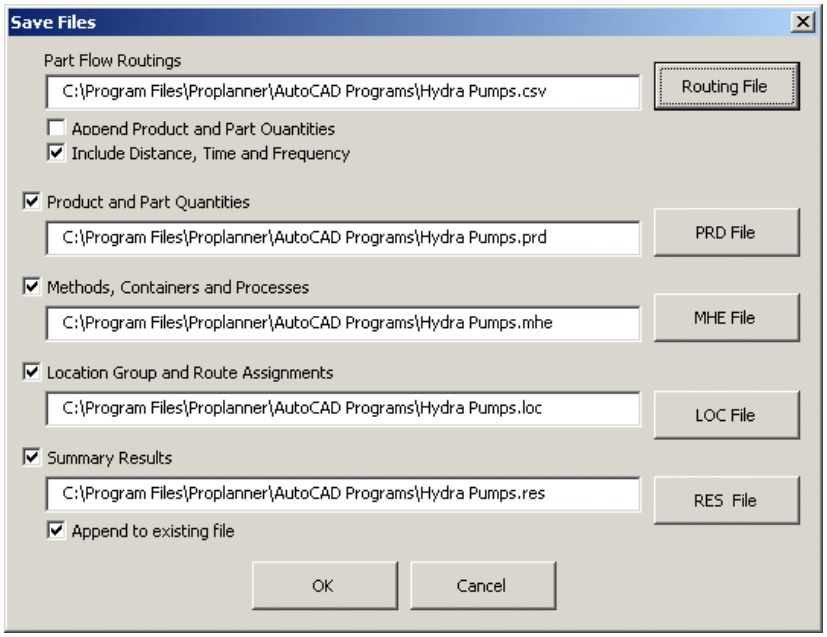
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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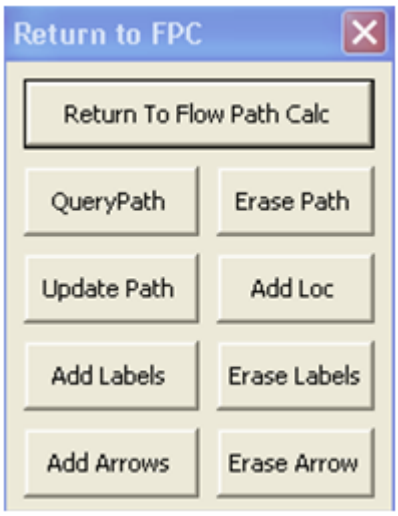
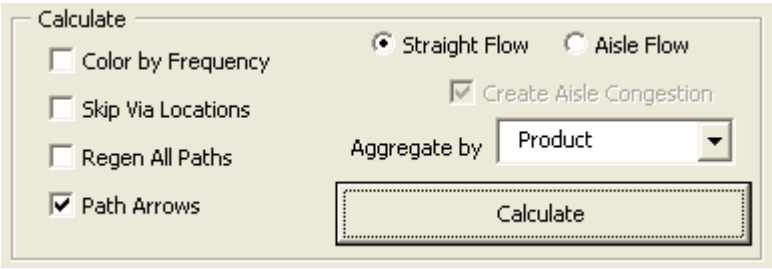


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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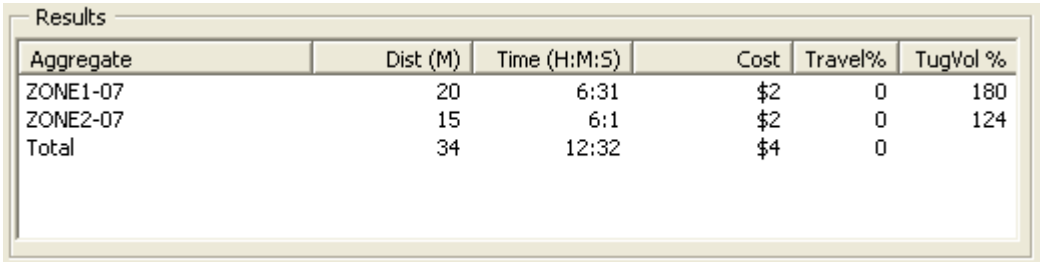
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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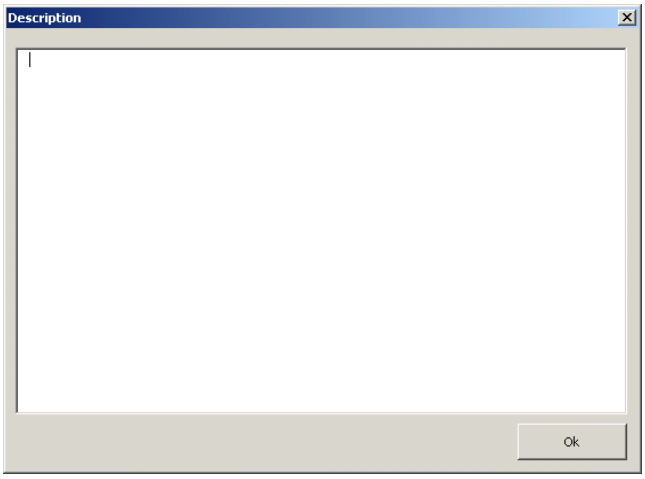
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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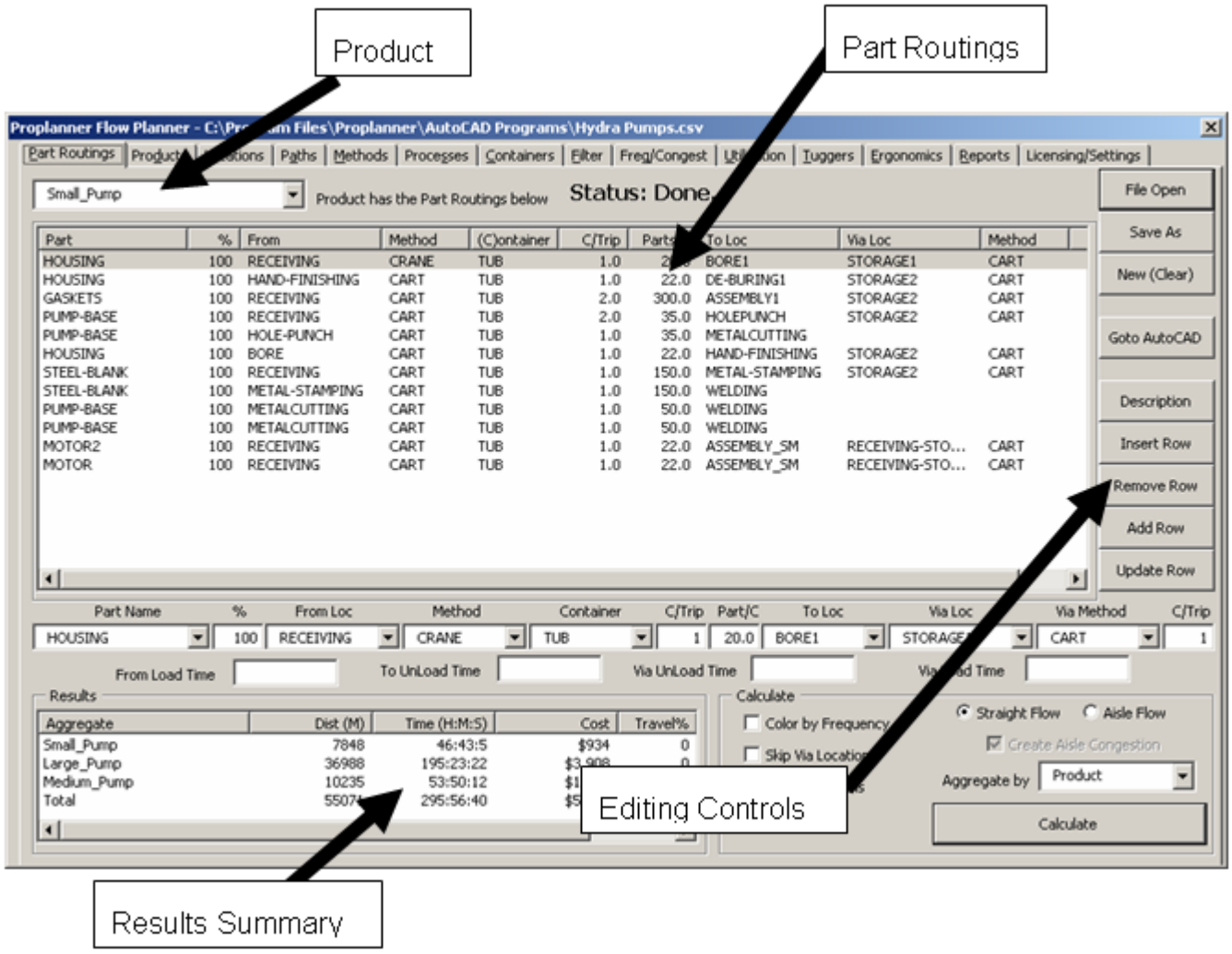
5.3.5 Editor Controls



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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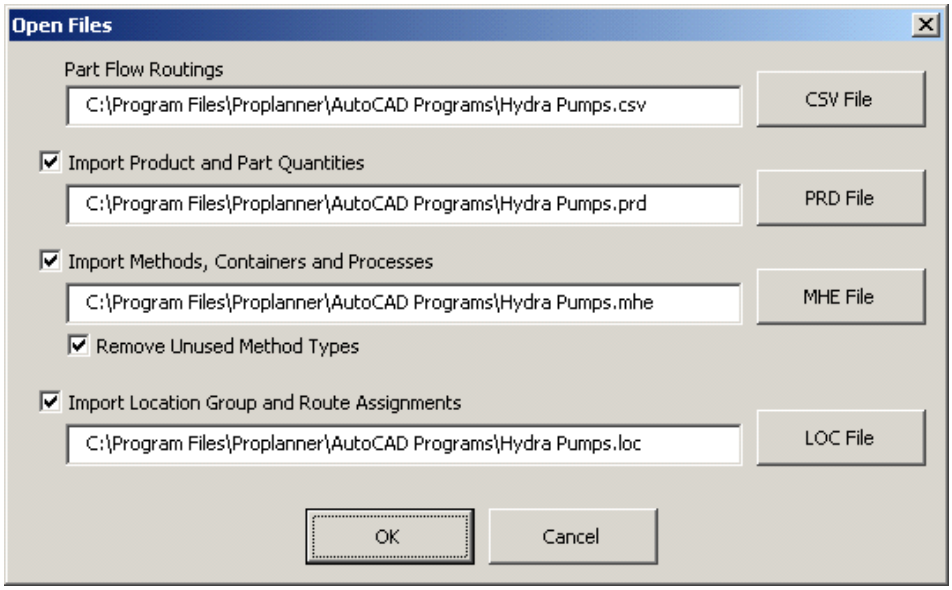
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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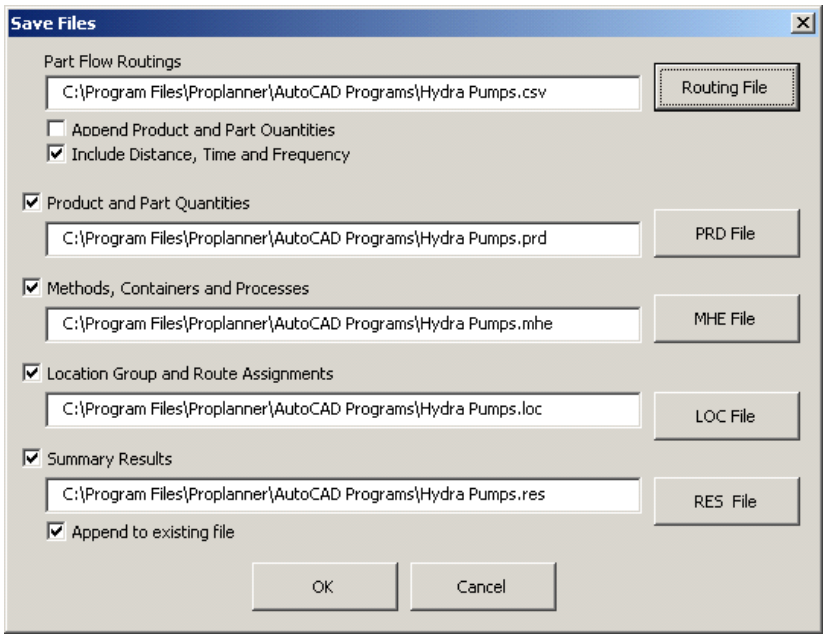
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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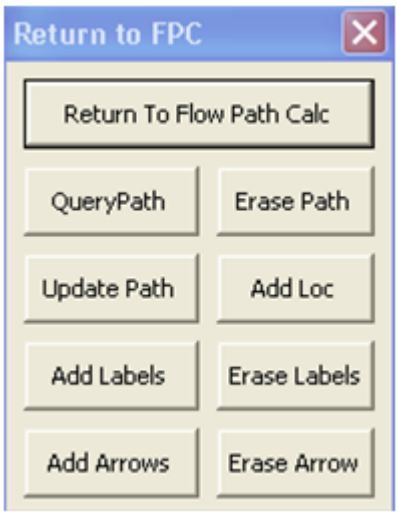
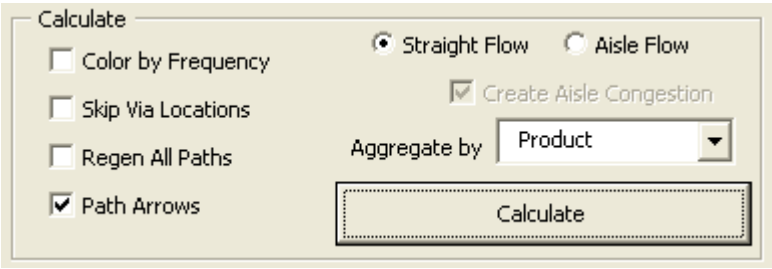


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

Prior to performing an Aisle flow study you will need to create an Aisle Path network (via the Add/Edit Aisle button in the bottom left of the Path tab window), and you will then want to select the Join Locs button to join your location points to the path network.

Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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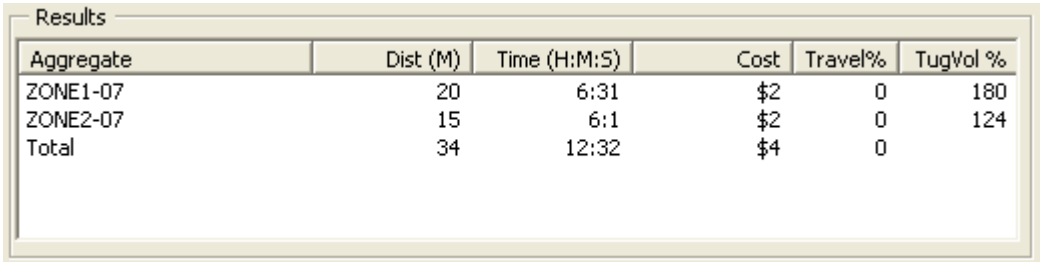
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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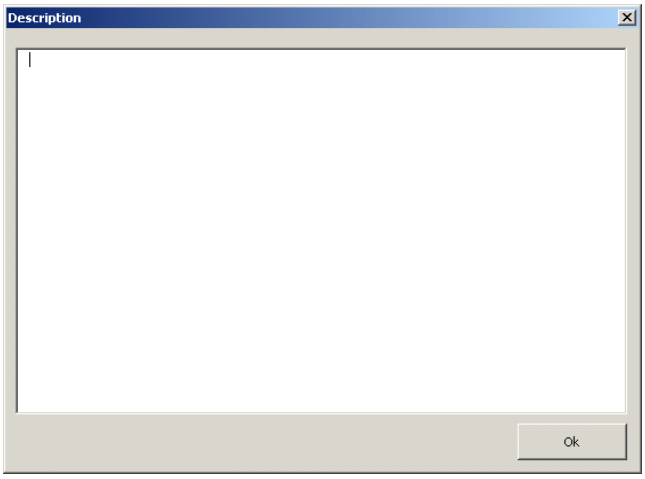
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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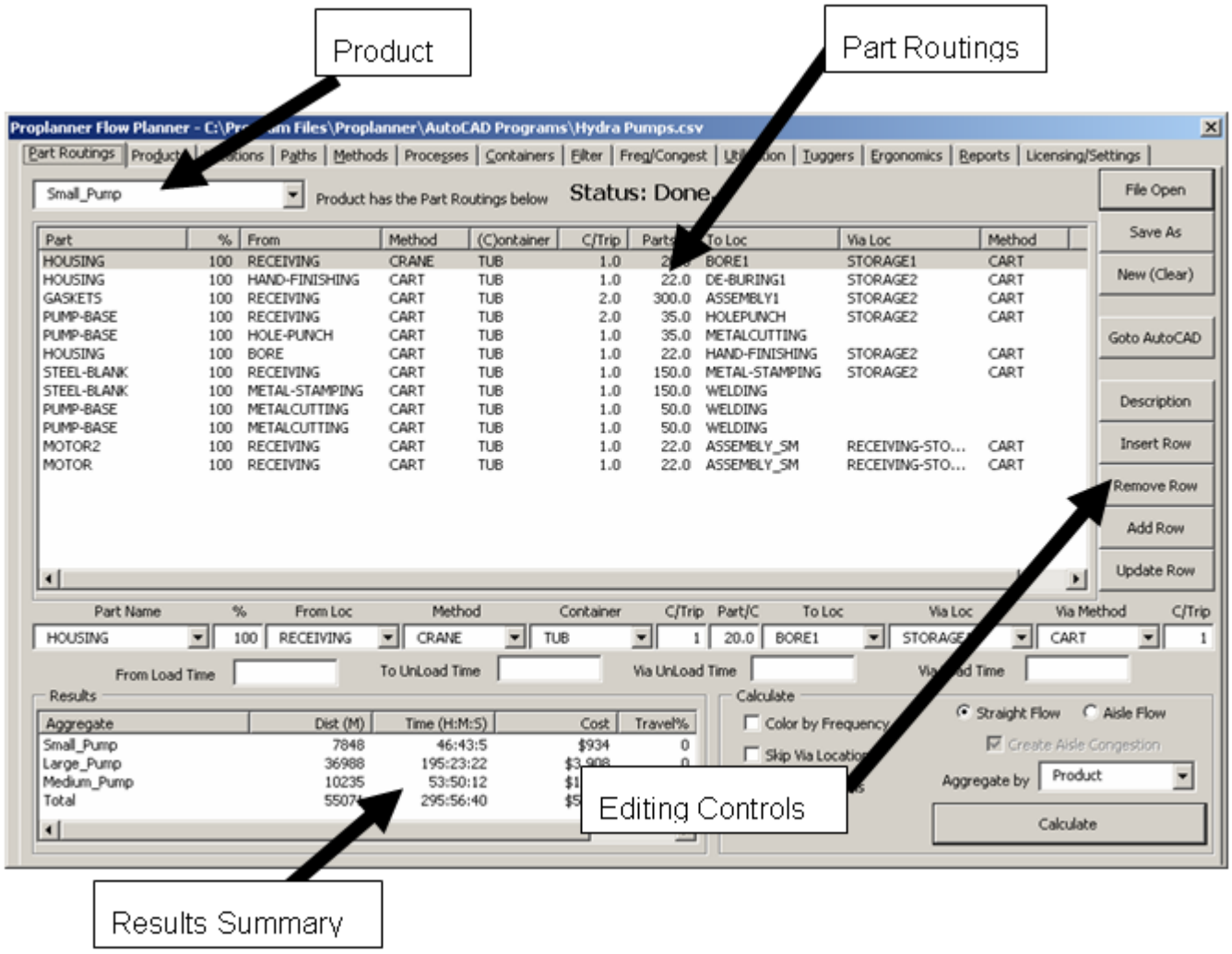
5.3.6 Route Format



The routings tab is the main window of the FP interface. In this window, you can Import, Save, and calculate your studies, as well as enter and edit part routings.

Flow routings are organized by Product names, which do not need to be actual products, but could instead be main flow path groupings. In each Product (flow grouping) you could have many parts (sub flow groupings) with multiple from-to and via location routings.

Product names are entered, or selected, in the top left combo box (showing Small_Pump). Once a name is entered, or selected, the associated Part routings for that Product selection will be shown in the main routings list view below. Routings may be added, removed or updated with the editing controls located in the middle-right of the screen.

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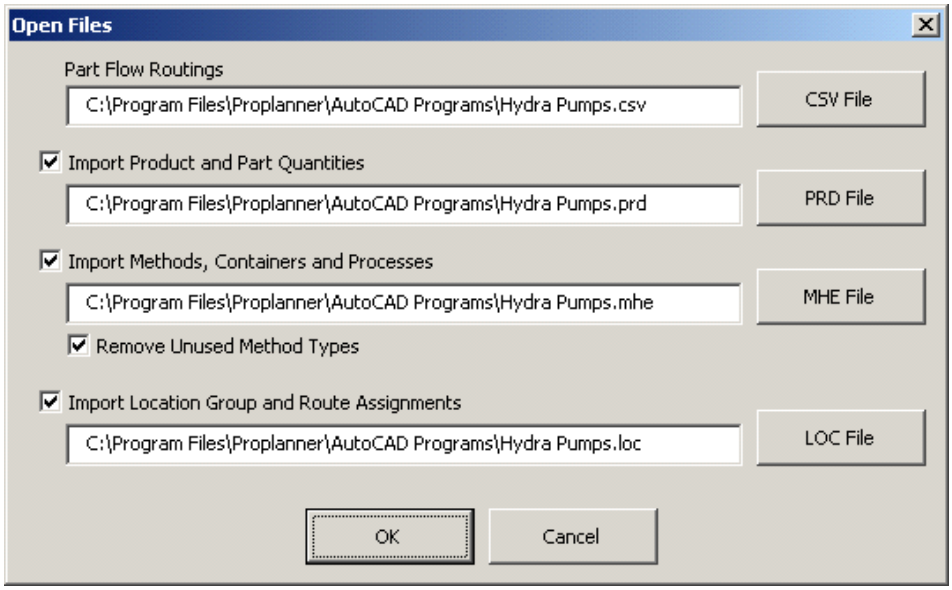
Main Controls

File Open: Loads the routing file into the routing editor and reads the drawing for locations referenced by the routing.



The routing file is a comma-delimited text file with a .csv extension. This file can be originally authored in the FP application or imported from an external application, such as MS Excel. The format to this main routing file is shown in the Appendix.

The routing file must be created in a contiguous manner with respect to the Product names (the first field of each line in the file). This means that all routings for a particular Product must be located together in the file. Future versions of the FP application will correct for this limitation.

At a minimum you need only create the routing file, as the FP application will create the information contained within the Products/Parts, Methods/Processes/Containers and Locations/Groups files automatically. Once these files are created, you will want to save them in order to record any changes that you have made. Next time you wish to load the routing file, you will be prompted for these additional files with the application screen shown above. In addition, you will have the option to remove unused method types that were created by the program when new methods were encountered in the part routings. Most of the time you will want to have this option selected.

When loading existing data files, the FP application will first load the part flow routings file and create all referenced parts, locations, methods, and containers. Then the FP application loads the corresponding products, methods and locations files and updates the user-specified quantity, color and option information. In this way, if the routing file contains locations, methods, parts or containers that did not exist in the last session they will be automatically added. Likewise, any locations, parts, or methods that no longer exist in the routing will not be loaded and thus will

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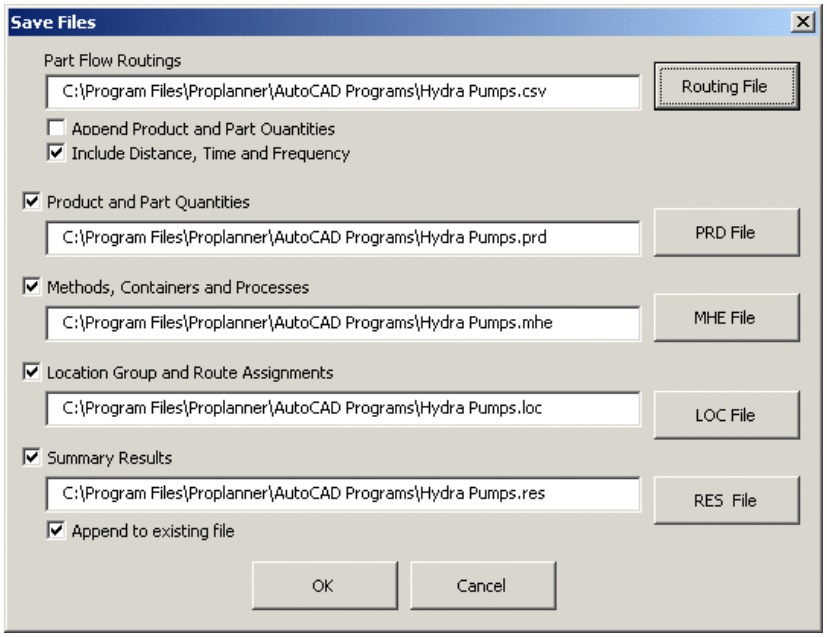
not appear in the editor.

In summary, the routing file is the master data set for the FP application and thus the Products/Parts, Locations/Groups and Methods/Containers/Processes files only serve to update the user-defined properties associated with those entities.

Save As: Saves the routings in the editor to a file, as well as optionally saving the corresponding Products/Parts, Locations/Groups and Methods/Processes/Containers data to their corresponding files. In addition, the results from the last calculation can also be saved to a new file or appended to an existing analysis results file.

- **Append product and part quantities**- Attaches quantities and names for products and parts to the CSV file. These originally come from the PRD file but can be attached here for ease of input and output checking. The user can now edit both route and part information in the same file.
- **Include distance, time, and frequency**- Attaches output frequencies, distances, and times to the input file so that it can be analyzed route by route.



New (Clear): Clears the current routings list, so that new routings may be entered.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)

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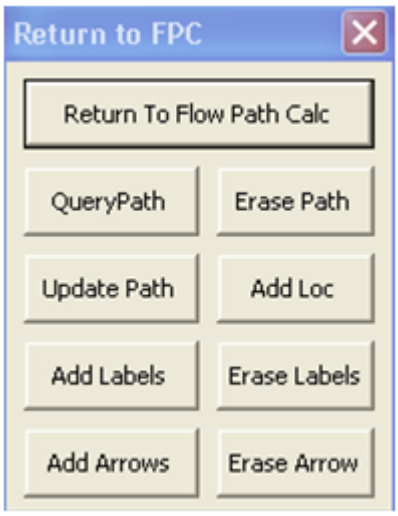
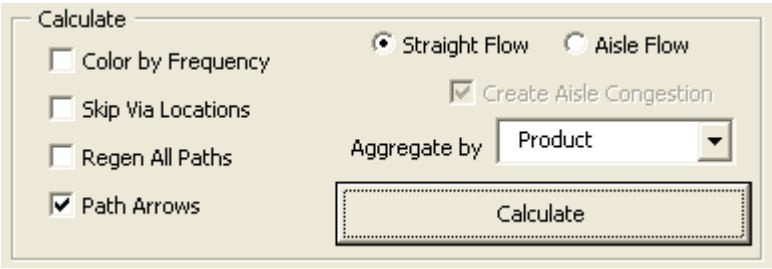


Modeless window displayed after Goto AutoCAD

Calculate



Calculate: The calculate button performs the distance, time, and cost calculations and generates and updates the flow paths. The calculation is aggregated according to the selected item in the "Aggregate-by" drop-down list. Please reference the Calculation Formula section for a better understanding of the calculation algorithms.

Calc first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing* do not appear in the *drawing*, then the FP will prompt the user to enter each location.

Each Aggregation (i.e. Product, Part, Method, Container, From-To Location, etc) is stored on its own unique set of layers. As such, one drawing file could contain the flow diagrams for all aggregations. Once the calc command finishes, the selected aggregation will be shown. To look at other aggregated flow diagrams, go to the Path Tab and select those aggregations from the top-left combo-box. If the congestion diagram is selected during an Aisle Flow aggregation, then the aggregation will be shown at the end of the calculation and thus the congestion diagram that was just created can only be seen by selecting the Congestion aggregation in the Paths tab.

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Straight or Aisle Flow: The Straight Flow and Aisle Flow radio buttons determine the route method for the generation of missing paths. Straight flow paths are typically the best for viewing where flows originate from and travel to, whereas Aisle path flows are best for evaluating actual travel distances, travel paths and aisle congestion.

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Congestion diagrams can only be created when an Aisle flow diagram is being generated. As the aisle congestion is the summary of all flows down specific aisle segments, it will be the same for any flow aggregation. Thus, there is only one aisle congestion diagram and this option should only be selected for one aggregation to save on processing time. Note that it is highly recommended to use the “Regen all Paths” option when creating congestion diagrams to ensure that all flow paths are included within the analysis.

To perform congestion analyses for specific products or method types go to either the Products or Methods tab and set their Calculate option to Yes while turning the undesired ones to No.

Finally the FP application has only one set of layers for each flow aggregation; therefore you will need to determine if your drawing is going to contain Aisle Flows or Straight Flows. If you wish to save both types of flow routes for each aggregation, then it is recommended that you create one layout drawing for Aisle Flow diagrams and another diagram for Straight Flow diagrams.

If the Aisle Path flows method is selected, and the FP application is unable to find any path from the FROM location to the TO or VIA location then the FP will default to using a Straight Flow method for that specific path. As such, if you see Straight Flow lines in your Aisle Flow study, look at your path network and make sure that intersecting aisle path lines exist from the insertion point of the originating Location text all the way to the insertion point of the destination Location text (also verify that aisle direction linestyles – IF USED - are appropriate for your direction of flow).

Color by Frequency: By default, the FP will color code the flow lines according to the aggregate color specified in the appropriate tab (i.e. Products and Parts, or Methods, or Containers, or Groups). Optionally you may color code the flows according to their trip frequency. Trip frequency colors and intensities are specified in the “Freq/Congest” tab.

Skip Via Locations: The routing file requires a minimum of a From and a To location for each route. In many factory logistics situations there is a storage area between the dock where the material is received and the line, or workstation, where the material is delivered. For these routings from the dock to the line via a storage location, you will want to enter the storage location

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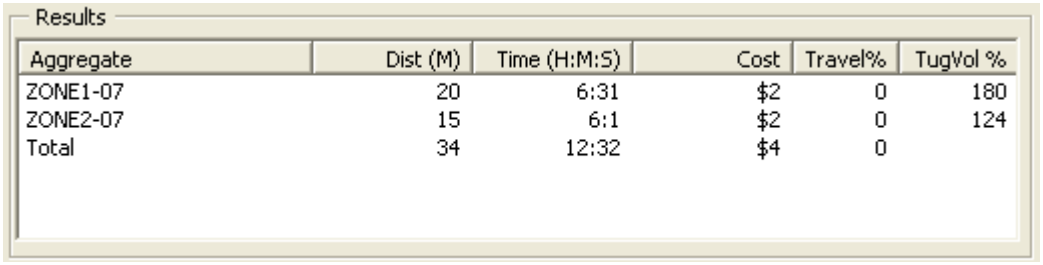
name in the “VIA” field of the part’s routing. Selecting the Skip-Via option will then allow the FP calculation to generate flow directly from the FROM location and to the TO location to quickly assist you in evaluating the travel issues caused by off-line storage locations.

Regen All Paths: If selected OFF, the FP application will only generate flow lines if they are missing in the drawing. As such, if the prior flow analysis was done using the Straight Flow method and your current analysis is using the Aisle-Path method, then only the new flow lines will be generated along the aisles. To delete all of the existing flow lines, and thus generate all new flow lines, you will want to select this option ON, before selecting the Calc button.

This selective path generation capability is useful if you have generated many manually routed paths and do not wish these to be deleted upon your next calculation. In addition, large studies will benefit from the performance advantages of re-generating only missing flow paths instead of all existing flow paths.

Path Arrows: If selected on, the FP will generate arrows at the end of all the flow lines. If arrows are not generated at the time of the calculation, then they can always be added later via the Arrows button in the Paths tab window.

Results



The Results table lists the aggregation summary statistics according to the selected aggregation method

Aggregate: The name of the aggregated flow method.

Dist (Ft): The total sum of the distance in Feet or Meters.

Time: The total sum of the time in Hours:Minutes:Seconds

Cost: The total sum of the cost by aggregate and by total. Note that only variable costs are shown with each aggregate and then these are totaled and added to the total fixed cost in the Cost total. The only exception to this is when the aggregate “Method Type” is selected. With this aggregate, the fixed costs are included for each method type in the individual aggregate summaries.

Travel%: The travel percentage is the percentage of time that is travel time versus

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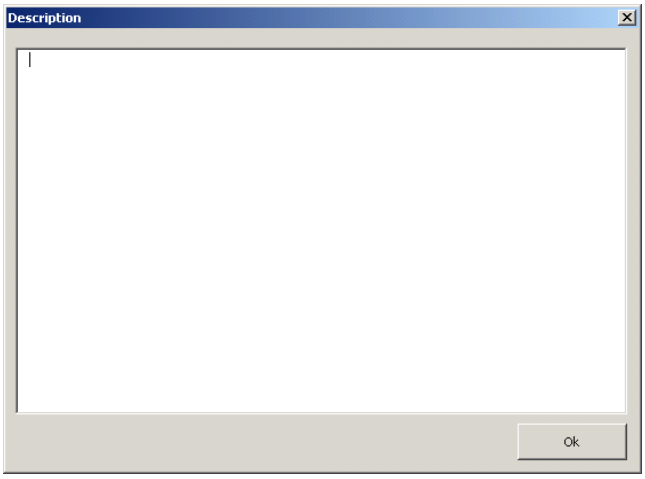
the total time which would also include Load and Unload times associated with each trip. This statistic is provided to aid in prioritizing your effort in reducing waste associated with traveling versus loading/unloading.

TugVol%: Used for Tugger Analysis to represent the percentage of a full tugger train required on this route.

Routing Editor Controls

Description: Allows you to add, and view, a description to each route.



Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the selected row into this new row as a default starting point.

Remove Row: Removes the selected row.

Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.

Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.

Route Format

Part: Name for part (or sub group of flow) moving along the stated route

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Route %: Percent of part flow for the stated part, in the stated product, taking this route.

From: From location for flow path analysis.

Method: Transport device (i.e. fork truck, AGV or hand cart) used to move the material from the FROM location to the TO location or the VIA location (if a via location is specified)

(C)ontainer: Name of container used for holding the parts and loading/unloading of the device. Often a pallet, tub, barrel, etc.

C/Trip: Quantity of containers that will fit in a typically loaded method

Parts/C: Quantity of Parts that will fit in a typically loaded container

To Loc: To location for flow path analysis.

Via Loc: Optional intermediate travel location, such as storage or a pass-thru point.

Method: Transport device (i.e. fork truck, AGV or hand car) used to move the material from the VIA location to the TO location (if a via location name is specified)

C/Trip: Quantity of containers that will fit in a typically loaded method from the Via location to the TO location (if a via location name is specified)

Note: The time fields below are **NOT** necessary.

From Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the From location.

To Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the To location.

Via Load Time: If this field contains data, this number will overwrite the load time specified on the Methods tab at the Via location.

Via Unload Time: If this field contains data, this number will overwrite the unload time specified on the Methods tab at the Via location.

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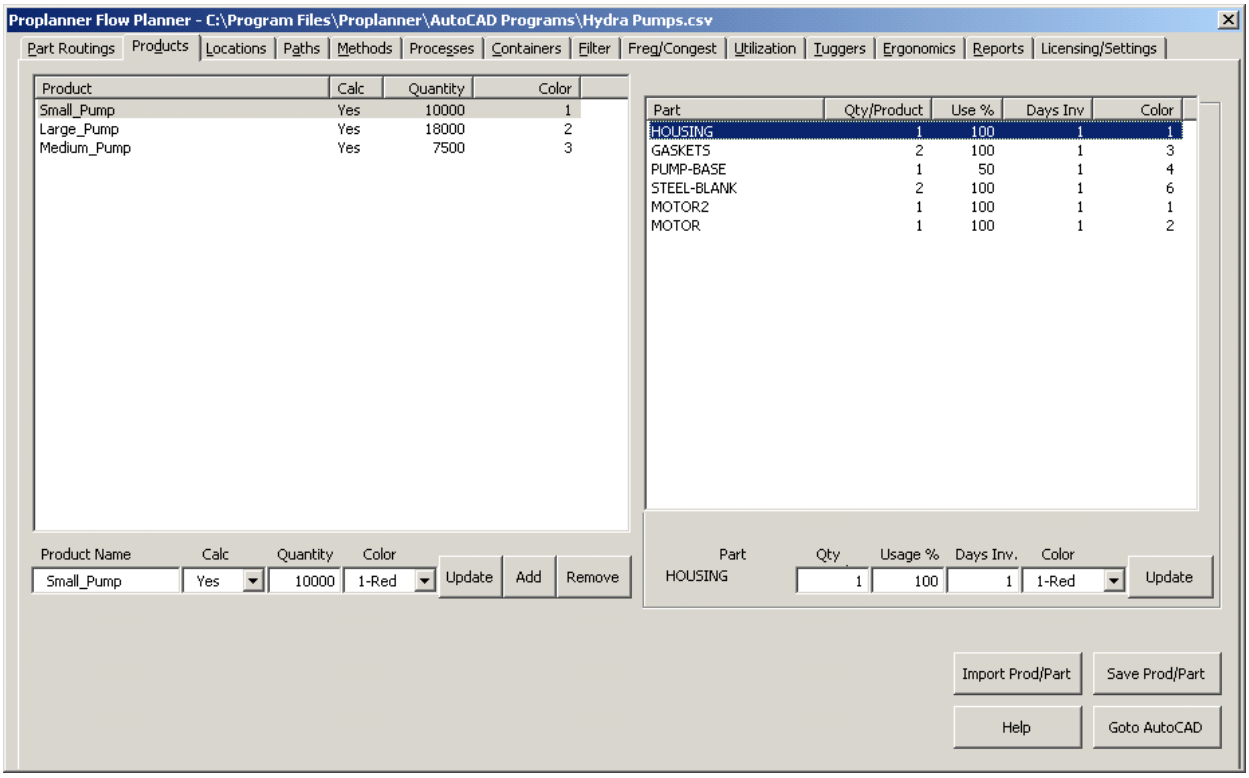
5.4 Products Tab



The Products tab is where you specify the quantity, color and calculation attributes for the Product (main flow groups) and Part (sub-flow groups) specified in the routing file. These tables will be created automatically by the program upon reading the routing file and then can be edited and saved for subsequent reloading.

Selecting a product in the list view on the left will change the available parts list referenced by that product in the list view on the right.

Products

Product Name – Name of the Product (main flow group). Changes to the name of the product in this field will subsequently change all like named products in the routings file. New products can be added to this list and then will appear in the product's pull-down list in the top-right of the routings window. You can also type in a new product name in the pull-down list in the routings window and that product will automatically appear in this Product list box.

Calc – Tells the FP if it should calculate flow diagrams, distances and costs for that Product. This feature is typically only used for studies with thousands of flow routes where it might be desired to speed up the calculation by not calculating products of interest. To filter the flow diagram by product, use the Filter tab features.

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Quantity – The Quantity of Products that will be multiplied by the quantity of Parts per Product.

Color – The color for the product layers created by the Product Aggregation.

Parts

Part Name – Name of the part (sub-flow group). Part names cannot be changed in this editor at this time.

Quantity/Product – The Quantity of Parts per referenced Product

Use % - The percentage of the referenced Product Quantity that uses this part in the aforementioned quantities.

Days Inventory – Not yet implemented

Color – The color for the Part and Product&Part layers created by the Part and Product&Part aggregations.

Import Prod/Part: Reads a new product/part file (of the extension .PRD) which will update the properties (color, quantity, percent, etc) of all Products and Parts found in the current routing.

Save Prod/Part: Saves the Product and Part properties to a product/part file (of the extension .PRD) for future use.

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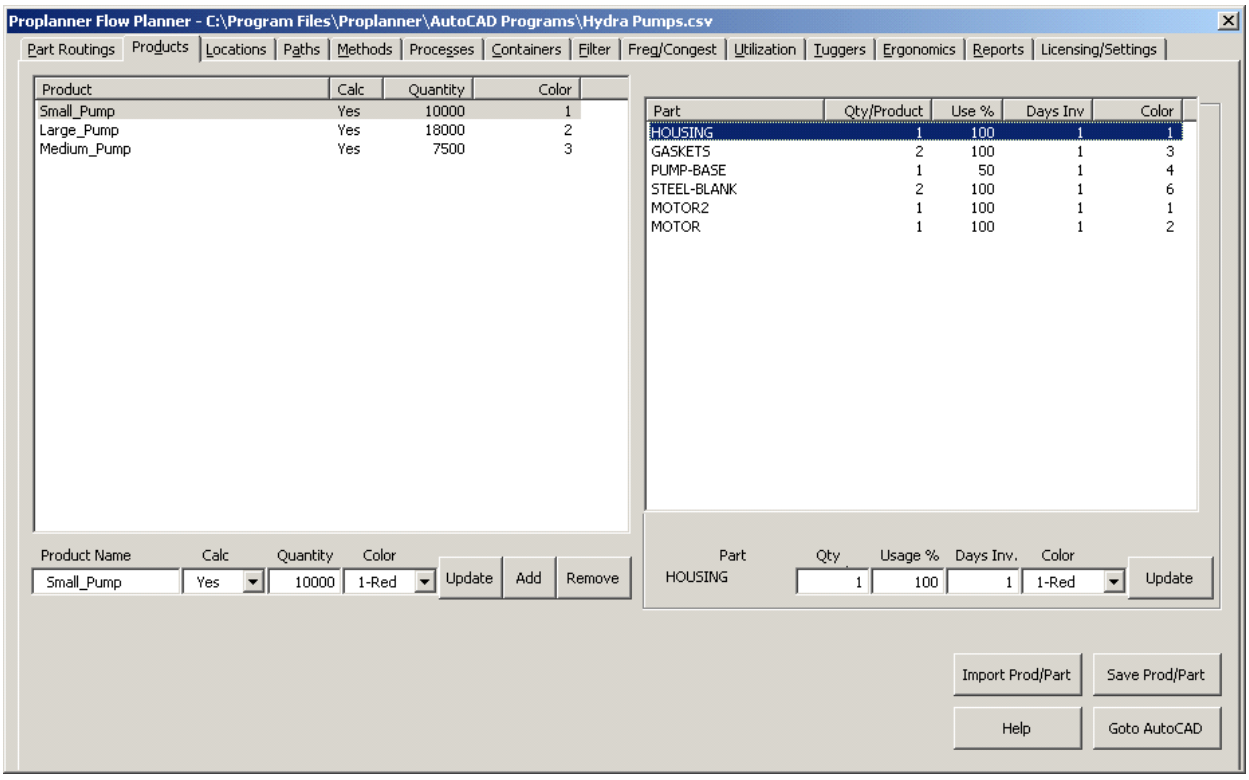
5.4.1 Products



The Products tab is where you specify the quantity, color and calculation attributes for the Product (main flow groups) and Part (sub-flow groups) specified in the routing file. These tables will be created automatically by the program upon reading the routing file and then can be edited and saved for subsequent reloading.

Selecting a product in the list view on the left will change the available parts list referenced by that product in the list view on the right.

Products

Product Name – Name of the Product (main flow group). Changes to the name of the product in this field will subsequently change all like named products in the routings file. New products can be added to this list and then will appear in the product's pull-down list in the top-right of the routings window. You can also type in a new product name in the pull-down list in the routings window and that product will automatically appear in this Product list box.

Calc – Tells the FP if it should calculate flow diagrams, distances and costs for that Product. This feature is typically only used for studies with thousands of flow routes where it might be desired to speed up the calculation by not calculating products of interest. To filter the flow diagram by product, use the Filter tab features.

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Quantity – The Quantity of Products that will be multiplied by the quantity of Parts per Product.

Color – The color for the product layers created by the Product Aggregation.

Parts

Part Name – Name of the part (sub-flow group). Part names cannot be changed in this editor at this time.

Quantity/Product – The Quantity of Parts per referenced Product

Use % - The percentage of the referenced Product Quantity that uses this part in the aforementioned quantities.

Days Inventory – Not yet implemented

Color – The color for the Part and Product&Part layers created by the Part and Product&Part aggregations.

Import Prod/Part: Reads a new product/part file (of the extension .PRD) which will update the properties (color, quantity, percent, etc) of all Products and Parts found in the current routing.

Save Prod/Part: Saves the Product and Part properties to a product/part file (of the extension .PRD) for future use.

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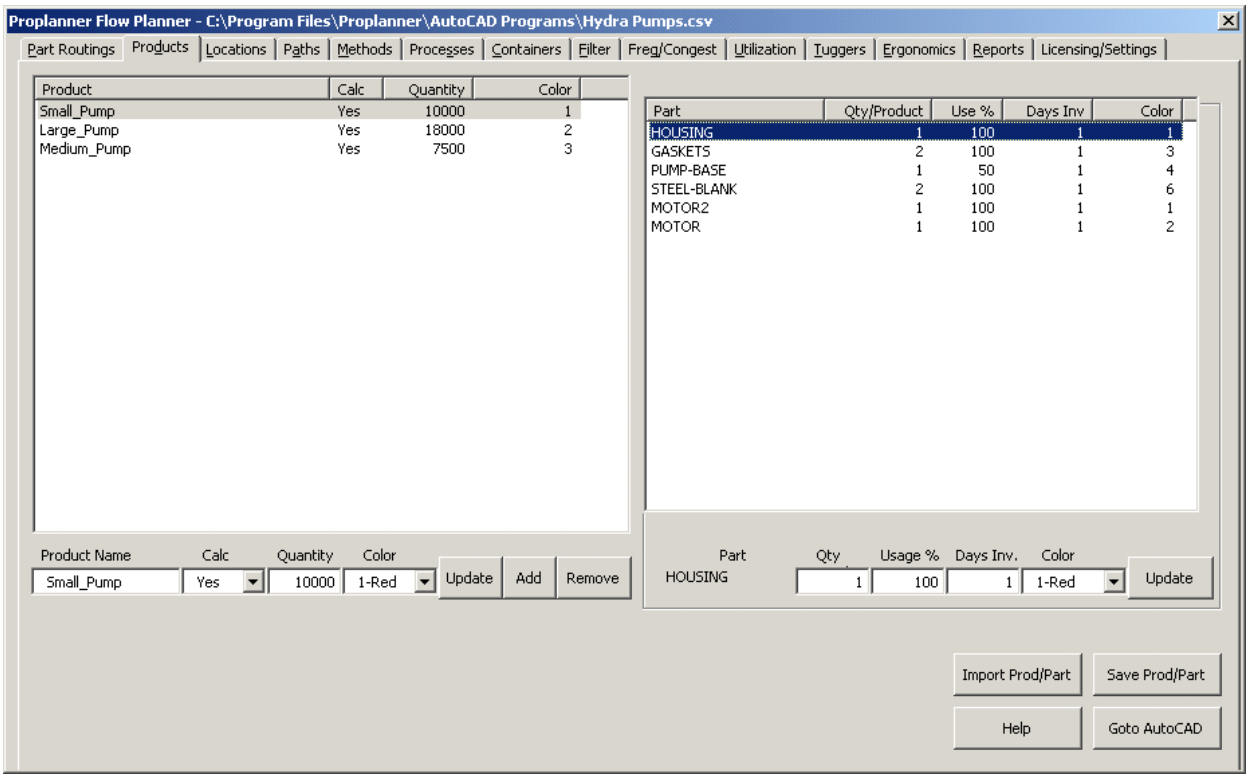
5.4.2 Parts



The Products tab is where you specify the quantity, color and calculation attributes for the Product (main flow groups) and Part (sub-flow groups) specified in the routing file. These tables will be created automatically by the program upon reading the routing file and then can be edited and saved for subsequent reloading.

Selecting a product in the list view on the left will change the available parts list referenced by that product in the list view on the right.

Products

Product Name – Name of the Product (main flow group). Changes to the name of the product in this field will subsequently change all like named products in the routings file. New products can be added to this list and then will appear in the product's pull-down list in the top-right of the routings window. You can also type in a new product name in the pull-down list in the routings window and that product will automatically appear in this Product list box.

Calc – Tells the FP if it should calculate flow diagrams, distances and costs for that Product. This feature is typically only used for studies with thousands of flow routes where it might be desired to speed up the calculation by not calculating products of interest. To filter the flow diagram by product, use the Filter tab features.

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Quantity – The Quantity of Products that will be multiplied by the quantity of Parts per Product.

Color – The color for the product layers created by the Product Aggregation.

Parts

Part Name – Name of the part (sub-flow group). Part names cannot be changed in this editor at this time.

Quantity/Product – The Quantity of Parts per referenced Product

Use % - The percentage of the referenced Product Quantity that uses this part in the aforementioned quantities.

Days Inventory – Not yet implemented

Color – The color for the Part and Product&Part layers created by the Part and Product&Part aggregations.

Import Prod/Part: Reads a new product/part file (of the extension .PRD) which will update the properties (color, quantity, percent, etc) of all Products and Parts found in the current routing.

Save Prod/Part: Saves the Product and Part properties to a product/part file (of the extension .PRD) for future use.

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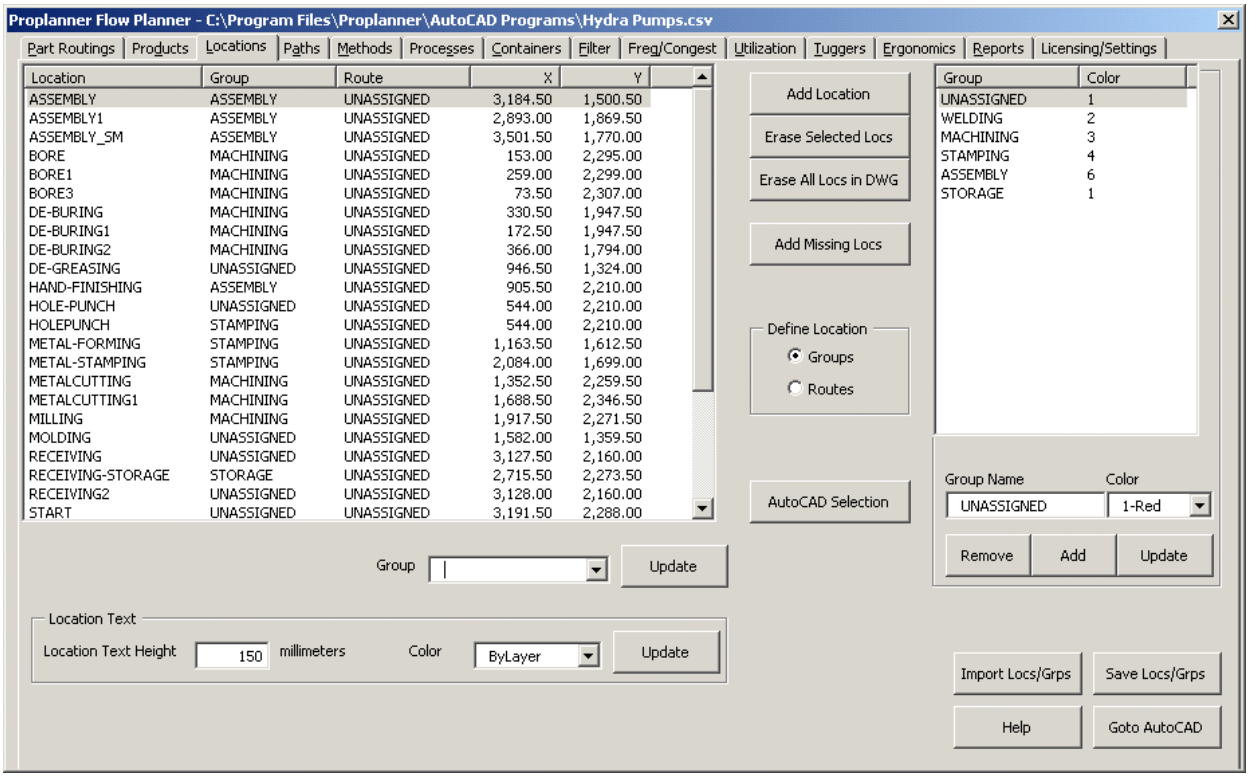
5.5 Locations Tab



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Goto AutoCAD: Hides the FP modal window and displays a smaller Modeless editing window.

Define Location

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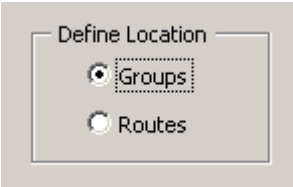
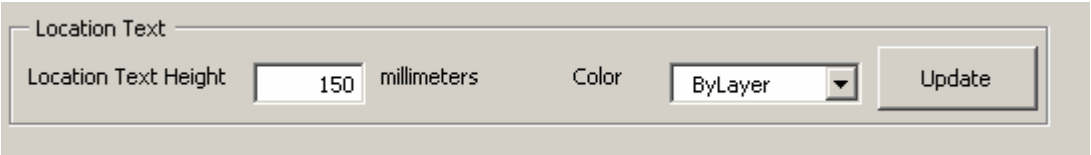


This set of radio buttons allows the user to select what set of groups they are seeing listed in the groups list view to the right. They can work with either the location groups or the tugger routes. Groups are used to aggregate flow diagrams and flow data between groups of locations (i.e. flow between assembly lines, instead of between each location on those lines). Routes are used by the Tugger module to assign locations to route drivers.

Location Text



Location Text Height: Specifying a new location text height.

Color: specify the color used for the location text. It could be “ByLayer”, “Group” or “Route”

Update: Will change the size and color of all text on the location text layer.

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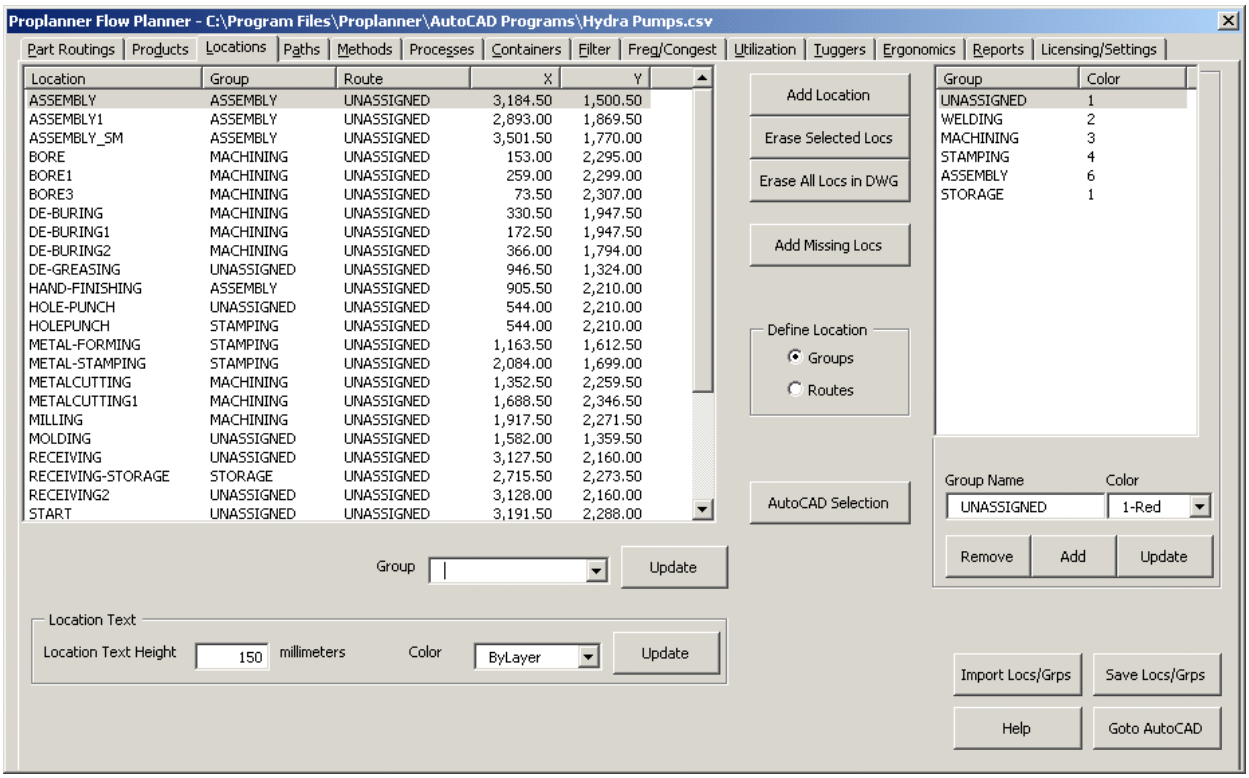
5.5.1 Location Table



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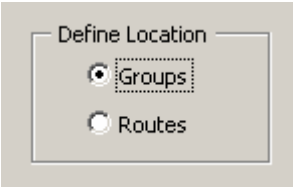

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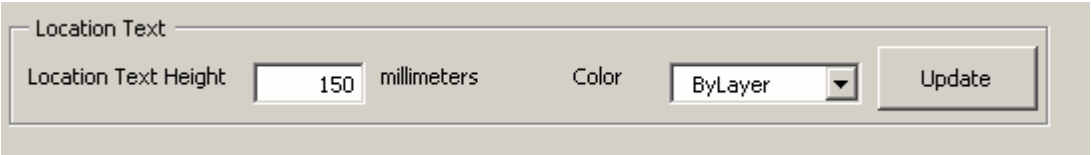

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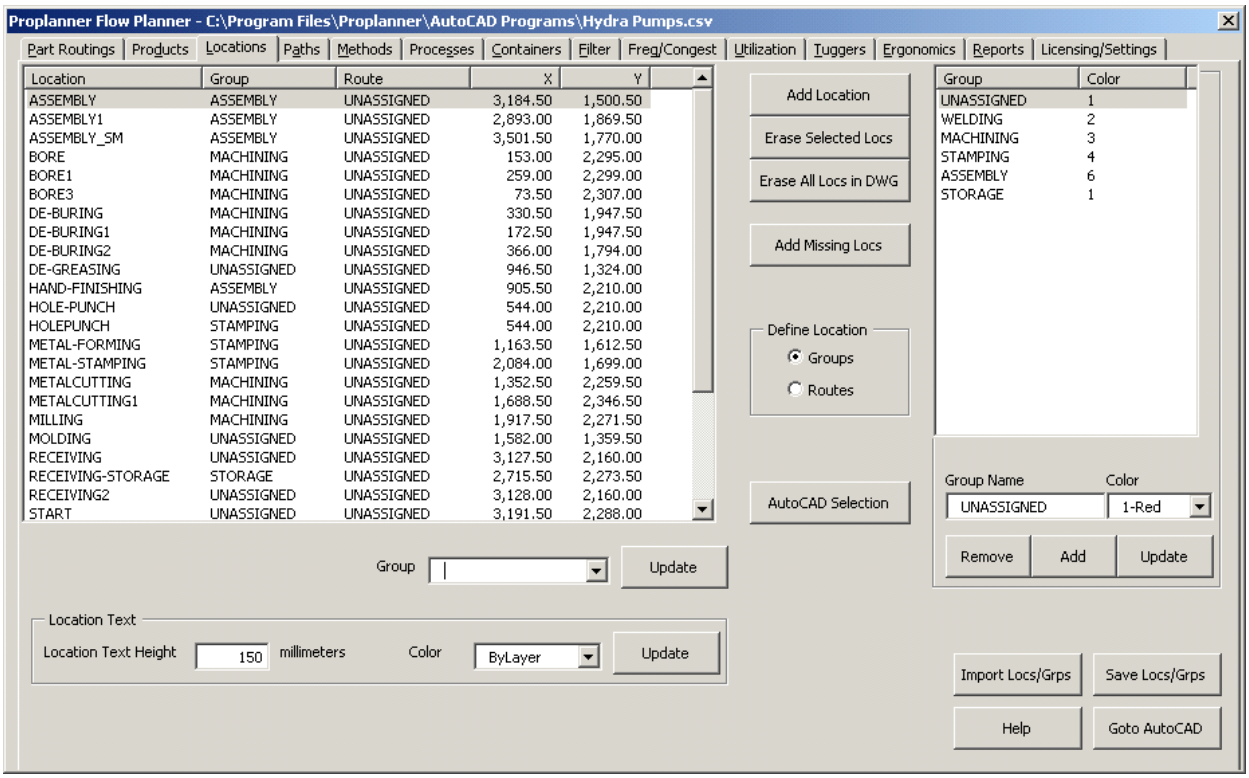
5.5.2 Group Table



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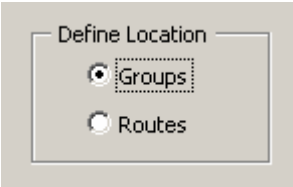

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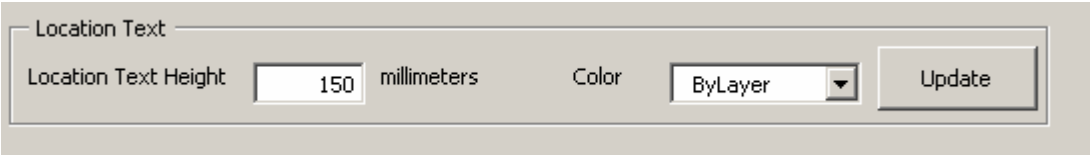

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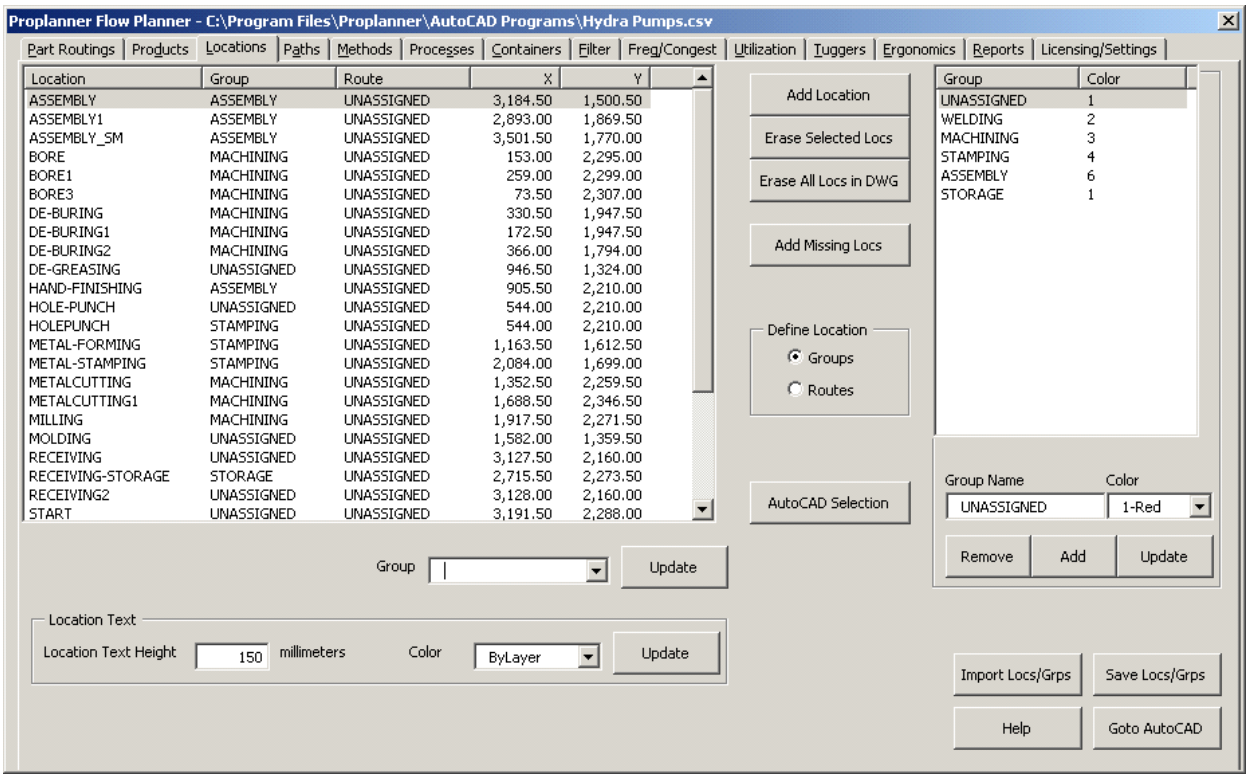

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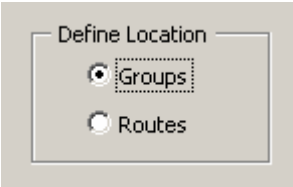

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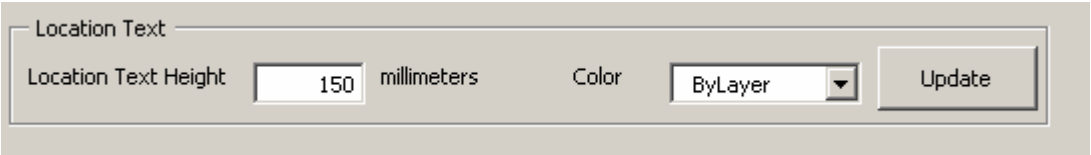

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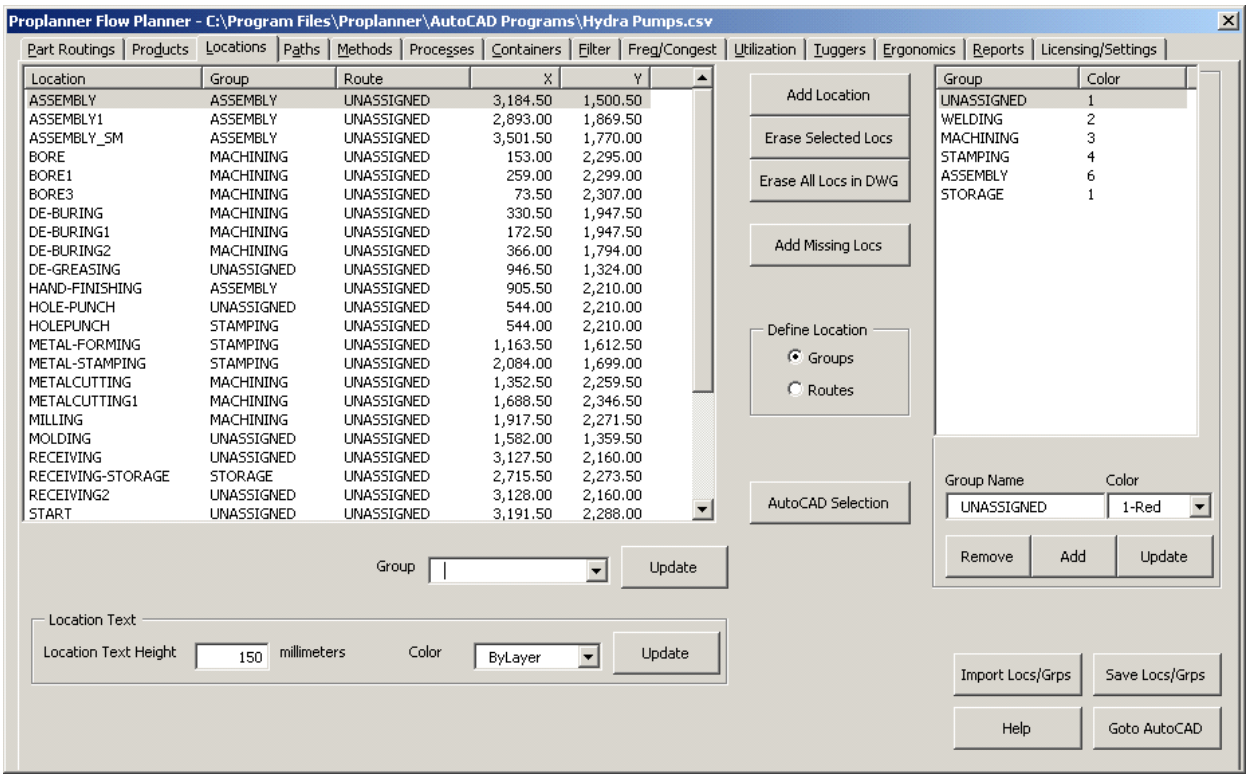

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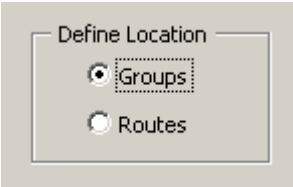

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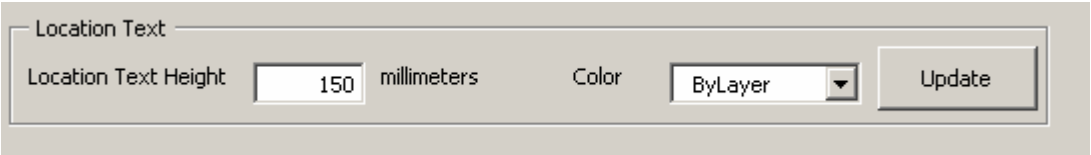

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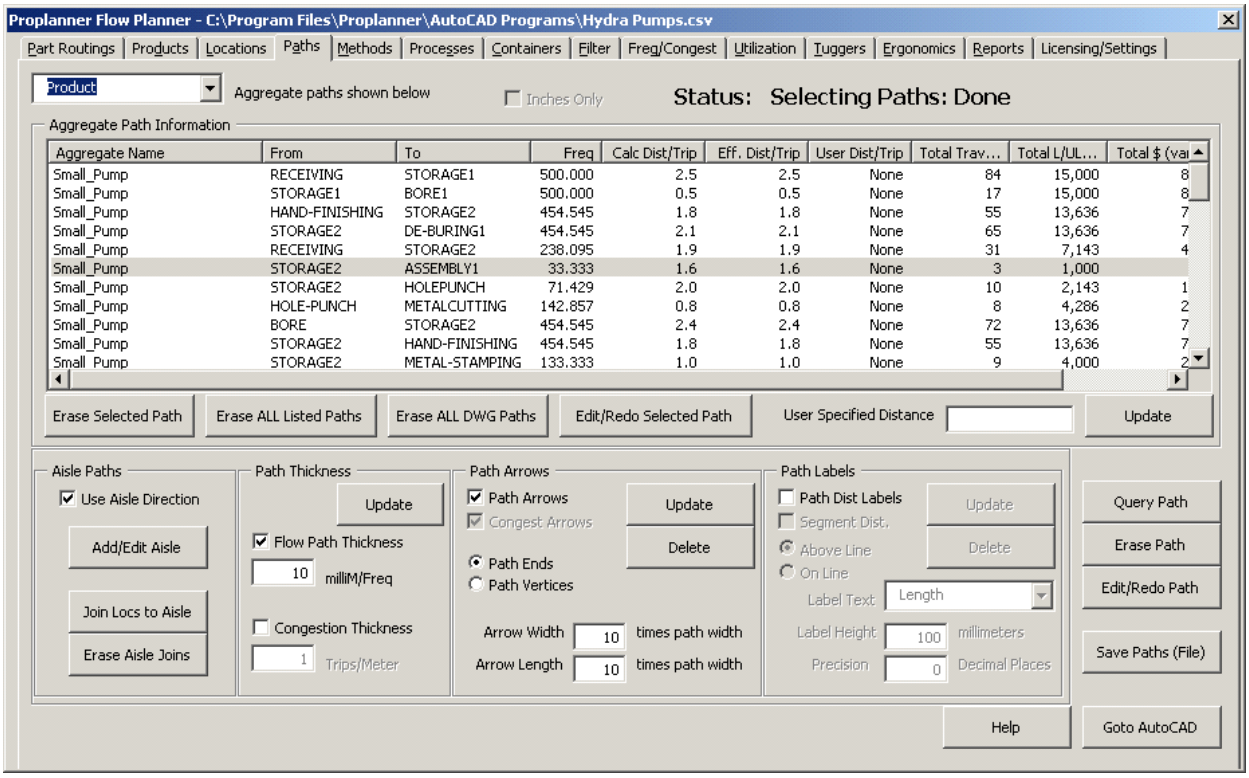
5.6 Paths Tab


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

The Paths tab is the main interface for path viewing, editing and annotation. The path list is filled from information embedded within the paths shown in the AutoCAD window for the selected aggregation method. Therefore, if there are no paths in AutoCAD for the selected aggregation, then no paths will be shown in the list view.

When you select an aggregation in the top-left pull-down list, the FP application will turn off all flow lines in the drawing and then turn on those flow lines for the selected aggregation and subsequently fill the list view with the information stored within those flow path polylines.

Since the information in the Paths window is pre-generated, it is not necessary to load the routing file and calculate it in order to view, query, filter, color code (via the Freq/Congest tab), delete or alter the thickness of the flow lines for all previously generated aggregations.

Aggregated Paths List Group

Aggregation Method: Selecting an aggregation method will filter the flow path lines in the drawing to only those for that method, and then the information within those lines will be displayed in the list view.

User Specified Distance Update: For all selected paths you can specify a path

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distance that will override the distance that the FP application computed from the drawing. This feature is useful for paths that may extend to other buildings, or locations not in the current drawing.

Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

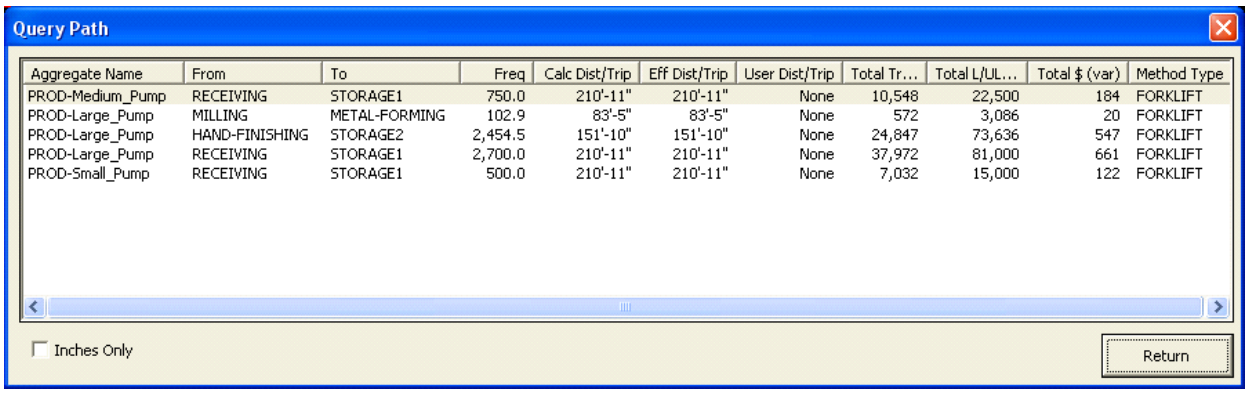
Erase All Listed Paths: Will erase all of the listed flow paths in the current drawing for the selected aggregation.

Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

Query Path: Hides the FP Modal window and allows you to select a flow path to query. Unlike the older versions of Flow Path, the user can now select multiple lines and must hit enter when done selecting the lines they wish to query. Then all the paths information will come up in the window below just like on the Paths tab.


Query Path
Aggregate Name From To Freq Calc Dist/Trip Eff Dist/Trip User Dist/Trip Total Tr... Total L/UL... Total $ (var) Method Type
PROD-Medium_Pump RECEIVING STORAGE1 750.0 210'-11" 210'-11" None 10,548 22,500 184 FORKLIFT
PROD-Large_Pump MILLING METAL-FORMING 102.9 83'-5" 83'-5" None 572 3,086 20 FORKLIFT
PROD-Large_Pump HAND-FINISHING STORAGE2 2,454.5 151'-10" 151'-10" None 24,847 73,636 547 FORKLIFT
PROD-Large_Pump RECEIVING STORAGE1 2,700.0 210'-11" 210'-11" None 37,972 81,000 661 FORKLIFT
PROD-Small_Pump RECEIVING STORAGE1 500.0 210'-11" 210'-11" None 7,032 15,000 122 FORKLIFT
Inches Only
Return

Erase Path: Will allow you to select a flow path in the drawing to erase.

Edit/Redo Path: Will allow you to select a flow path in the drawing to specify a manual route for.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. You can also execute any AutoCAD command on the menus or command line.

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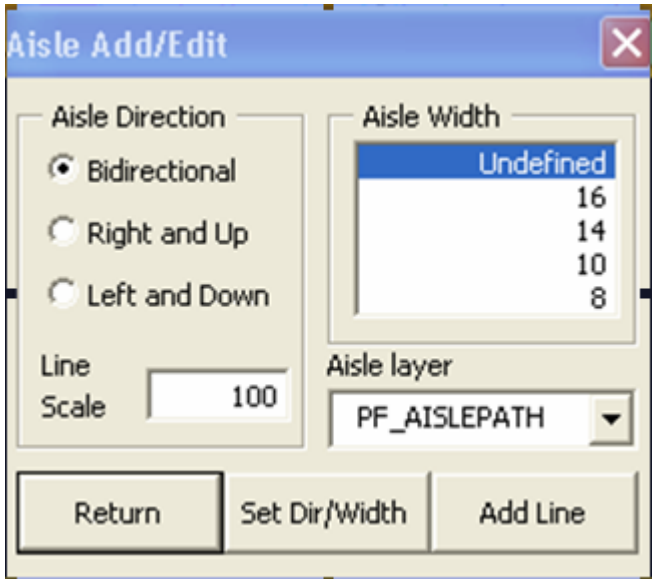
If the lines have the linetype of "BYLAYER" then those lines are assumed to represent bi-directional flows. Otherwise, if the line is labeled with "UR" then the line represents flow only in the direction of 0 to 179 degrees. If the line is labeled with "DL" then the line represents flow only in the direction of 180 to 359 degrees. Selecting the Add/Edit Aisle button will allow you to easily set these linetypes.

The FP application allows you to specify more than one layer for your aisle lines. You are then allowed to assign these layers to your Method Types so that you can specify a different set of aisles for Fork Trucks versus those for People or AGV's (for example).

Use Aisle Direction: Allows you to create aisle path lines and edit the direction and width of existing aisle lines. You can only add lines on the layers specified in the pull-down list. These layers come from the specified layers for the method types in your current session. Therefore, if you wish to add a layer to draw aisle lines on, you will need to first add that layer to one of your Method types in the Methods tab.



Incorrect Aisle Drawing: If the aisle paths are drawn incorrectly, this will cause the

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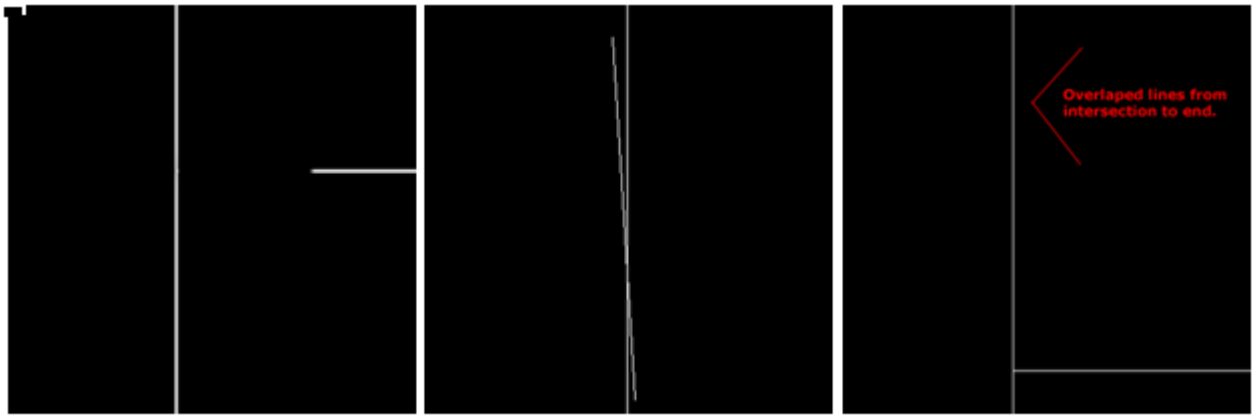

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Join Locs to Aisle: Lines must be connected from each Location text insertion point to an aisle path line in order for the FP application to know how to get to, and from, that location. You can manually draw the line from the insertion point (make sure to use your object snap modes) to another aisle path line, or you can select this button and have those lines drawn for you.

When the FP application automatically creates “Join Lines” from each Location text to the aisle network it does so by selecting the closest aisle path line perpendicular, or end-point connection. Join lines are placed on a layer of the same name as the user-specified aisle path layer plus the following extension “-JOIN”. In this way, the FP application can easily remove these lines and recreate them as the Location points are moved around in the drawing by the user.

While you can use this “-JOIN” layer to manually draw connecting lines from the Location text to the aisle network, the program will remove these lines whenever the Erase Aisle Joins button is selected. As such, it is recommended that all manually joined Locations are created on the same layer in which the aisle path lines are drawn.

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In the case where multiple aisle path layers exist, the “Join Locs” command will only join Location text to an aisle path line on a particular layer if that location is referenced in a routing that uses a method that references a method type that is

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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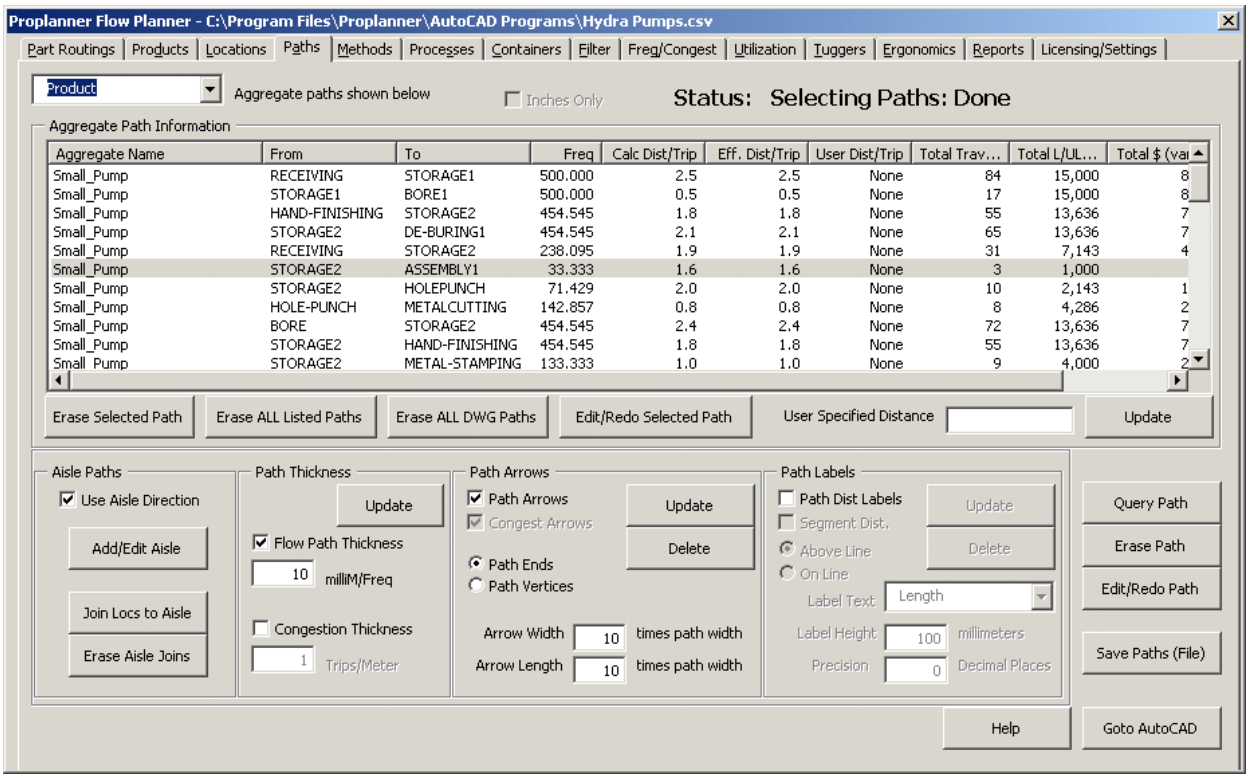
5.6.1 Aggregated paths list group


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

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When you select an aggregation in the top-left pull-down list, the FP application will turn off all flow lines in the drawing and then turn on those flow lines for the selected aggregation and subsequently fill the list view with the information stored within those flow path polylines.

Since the information in the Paths window is pre-generated, it is not necessary to load the routing file and calculate it in order to view, query, filter, color code (via the Freq/Congest tab), delete or alter the thickness of the flow lines for all previously generated aggregations.

Aggregated Paths List Group

Aggregation Method: Selecting an aggregation method will filter the flow path lines in the drawing to only those for that method, and then the information within those lines will be displayed in the list view.

User Specified Distance Update: For all selected paths you can specify a path

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Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

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Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

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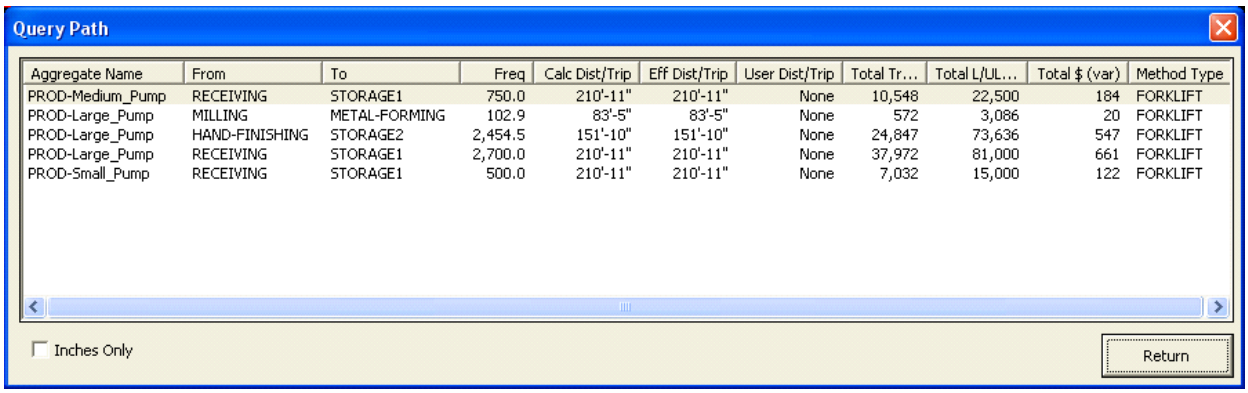
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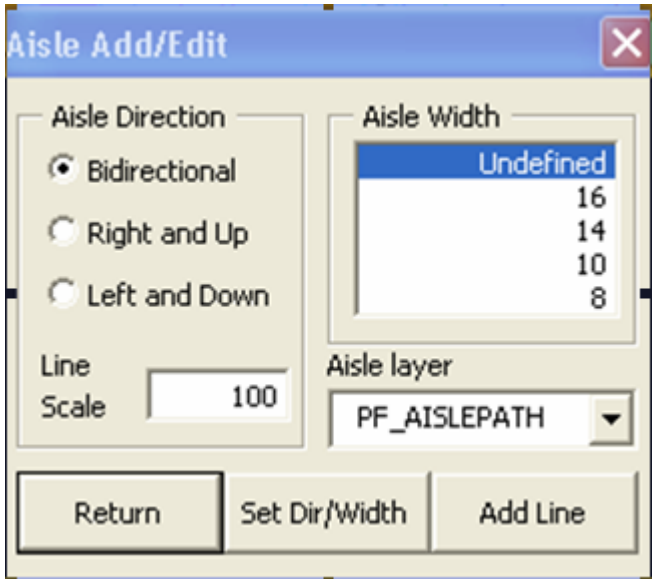

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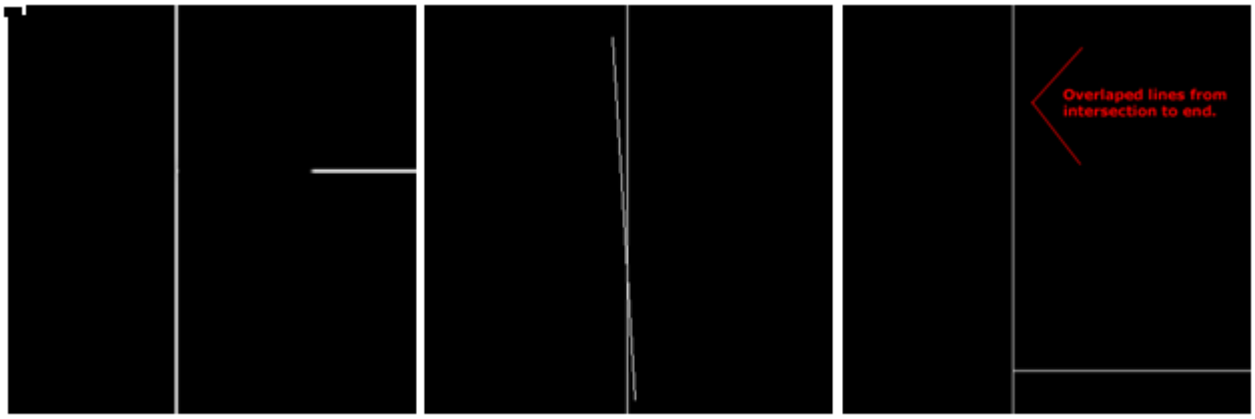

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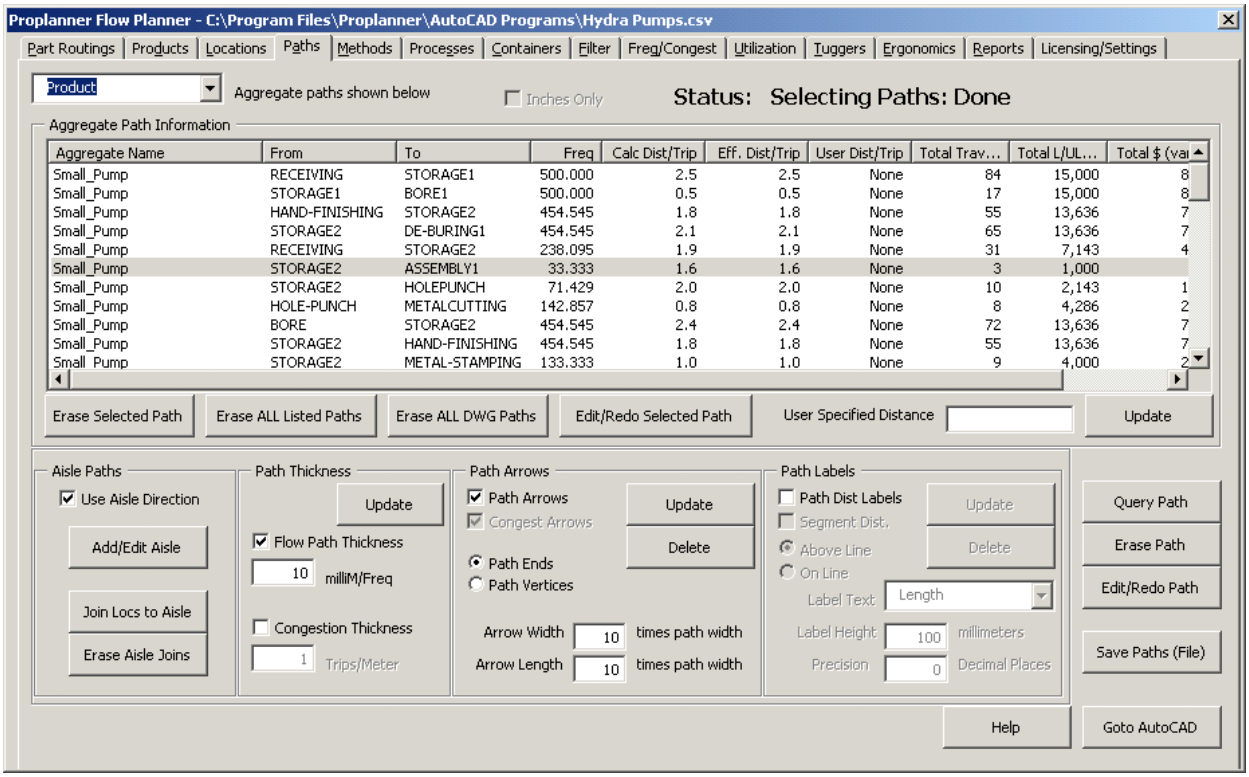
5.6.2 Editing commands in bottom right of screen



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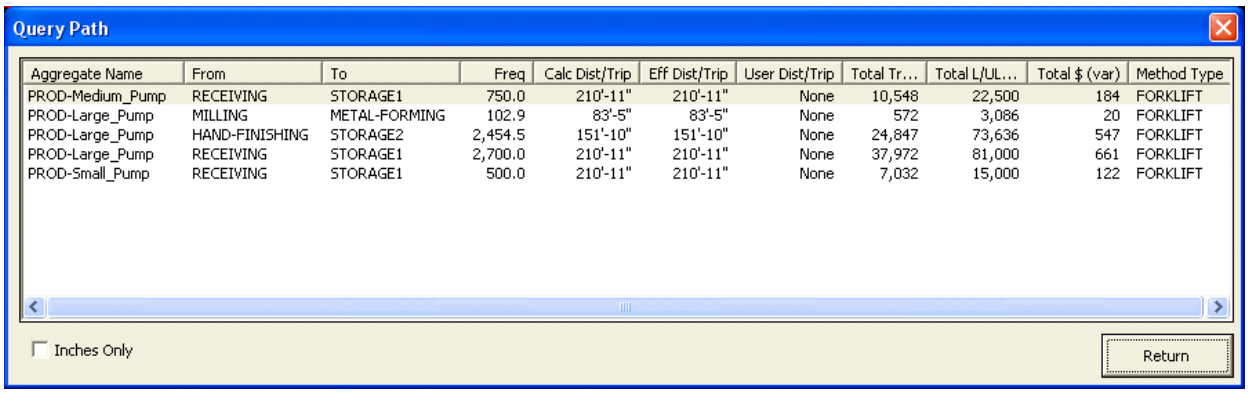
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PROD-Large_Pump | HAND-FINISHING | STORAGE2 | 2,454.5 | 151'-10" | 151'-10" | None | 24,847 | 73,636 | 547 | FORKLIFT
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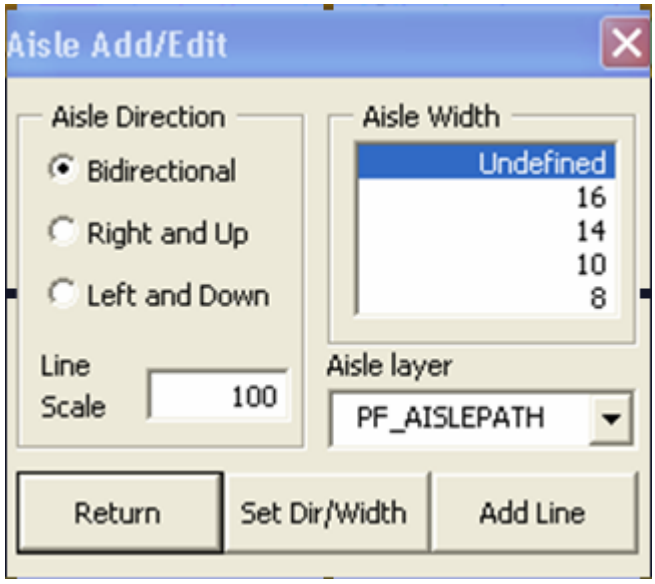

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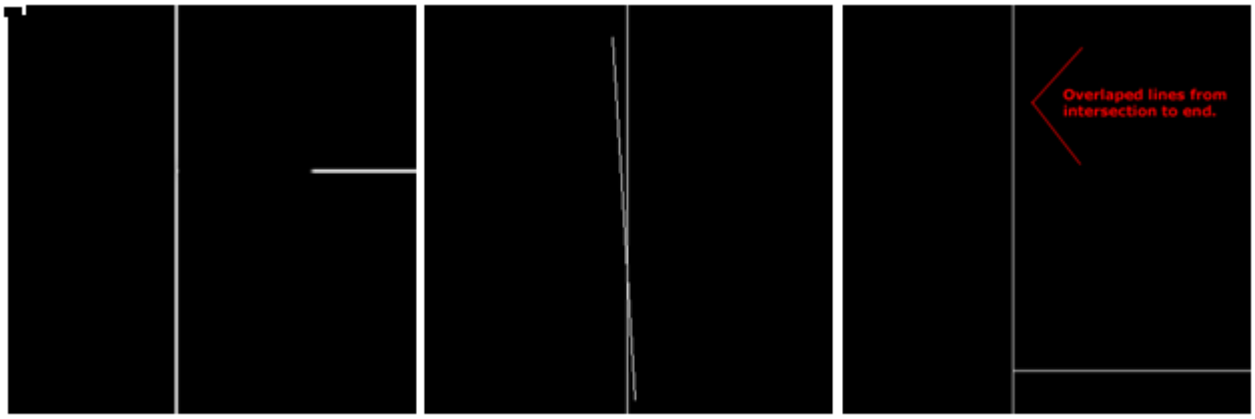

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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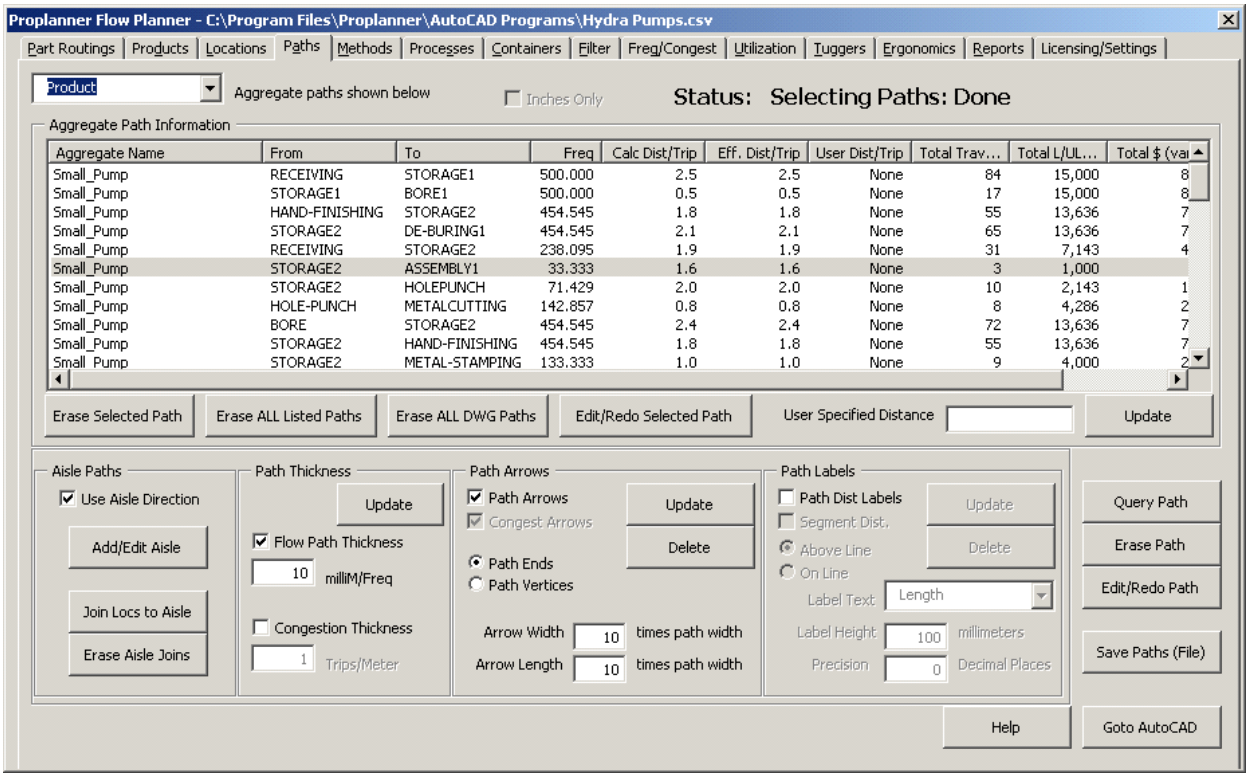
5.6.3 Aisle paths


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

The Paths tab is the main interface for path viewing, editing and annotation. The path list is filled from information embedded within the paths shown in the AutoCAD window for the selected aggregation method. Therefore, if there are no paths in AutoCAD for the selected aggregation, then no paths will be shown in the list view.

When you select an aggregation in the top-left pull-down list, the FP application will turn off all flow lines in the drawing and then turn on those flow lines for the selected aggregation and subsequently fill the list view with the information stored within those flow path polylines.

Since the information in the Paths window is pre-generated, it is not necessary to load the routing file and calculate it in order to view, query, filter, color code (via the Freq/Congest tab), delete or alter the thickness of the flow lines for all previously generated aggregations.

Aggregated Paths List Group

Aggregation Method: Selecting an aggregation method will filter the flow path lines in the drawing to only those for that method, and then the information within those lines will be displayed in the list view.

User Specified Distance Update: For all selected paths you can specify a path

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distance that will override the distance that the FP application computed from the drawing. This feature is useful for paths that may extend to other buildings, or locations not in the current drawing.

Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

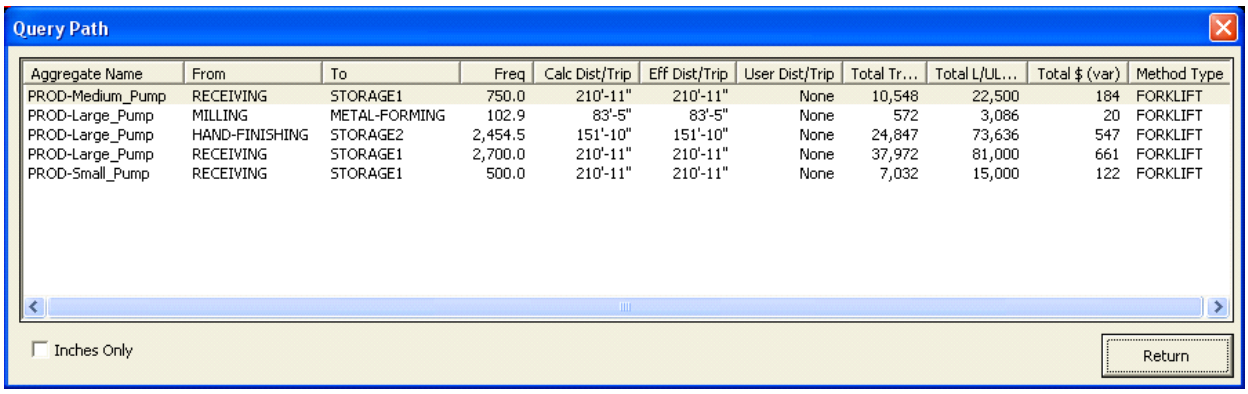
Erase All Listed Paths: Will erase all of the listed flow paths in the current drawing for the selected aggregation.

Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

Query Path: Hides the FP Modal window and allows you to select a flow path to query. Unlike the older versions of Flow Path, the user can now select multiple lines and must hit enter when done selecting the lines they wish to query. Then all the paths information will come up in the window below just like on the Paths tab.


Query Path
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff Dist/Trip | User Dist/Trip | Total Tr... | Total L/UL... | Total $ (var) | Method Type
PROD-Medium_Pump | RECEIVING | STORAGE1 | 750.0 | 210'-11" | 210'-11" | None | 10,548 | 22,500 | 184 | FORKLIFT
PROD-Large_Pump | MILLING | METAL-FORMING | 102.9 | 83'-5" | 83'-5" | None | 572 | 3,086 | 20 | FORKLIFT
PROD-Large_Pump | HAND-FINISHING | STORAGE2 | 2,454.5 | 151'-10" | 151'-10" | None | 24,847 | 73,636 | 547 | FORKLIFT
PROD-Large_Pump | RECEIVING | STORAGE1 | 2,700.0 | 210'-11" | 210'-11" | None | 37,972 | 81,000 | 661 | FORKLIFT
PROD-Small_Pump | RECEIVING | STORAGE1 | 500.0 | 210'-11" | 210'-11" | None | 7,032 | 15,000 | 122 | FORKLIFT
Inches Only
Return

Erase Path: Will allow you to select a flow path in the drawing to erase.

Edit/Redo Path: Will allow you to select a flow path in the drawing to specify a manual route for.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. You can also execute any AutoCAD command on the menus or command line.

Save Paths (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of flow path distances to

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other applications. The FP application does not read this file.

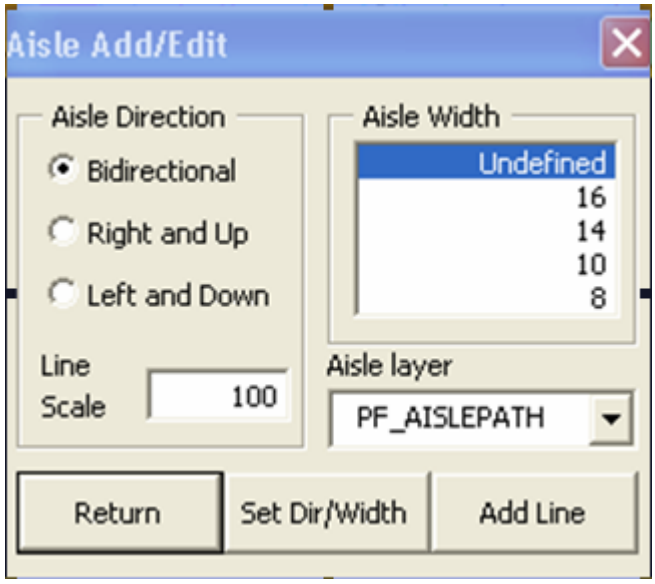
Aisle Paths

The FP application can automatically generate flow path lines down the aisles of your factory drawing using a shortest path algorithm to find the best route. To perform this function, the FP application references a layer in AutoCAD that contains lines (not polylines) that show the valid routes. If these lines intersect, then the FP application assumes an intersection.

If the lines have the linetype of “BYLAYER” then those lines are assumed to represent bi-directional flows. Otherwise, if the line is labeled with “UR” then the line represents flow only in the direction of 0 to 179 degrees. If the line is labeled with “DL” then the line represents flow only in the direction of 180 to 359 degrees. Selecting the Add/Edit Aisle button will allow you to easily set these linetypes.

The FP application allows you to specify more than one layer for your aisle lines. You are then allowed to assign these layers to your Method Types so that you can specify a different set of aisles for Fork Trucks versus those for People or AGV’s (for example).

Use Aisle Direction: Allows you to create aisle path lines and edit the direction and width of existing aisle lines. You can only add lines on the layers specified in the pull-down list. These layers come from the specified layers for the method types in your current session. Therefore, if you wish to add a layer to draw aisle lines on, you will need to first add that layer to one of your Method types in the Methods tab.



Incorrect Aisle Drawing: If the aisle paths are drawn incorrectly, this will cause the

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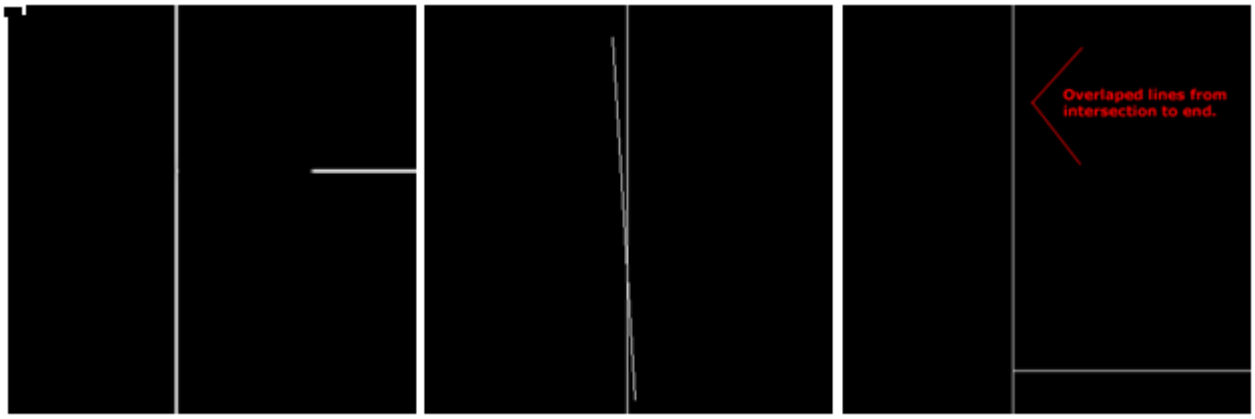
calculation to produce straight line flows. Below are examples of the most common ways to cause problems by incorrectly drawing aisle path lines.



Disconnected Lines Minute Crossovers Overlapping

Most of these errors are only viewable zoomed in or if you know where you overlapped. To avoid these issues, the best way is to try and draw the entire aisle network at once, instead of making many individual lines. If these issues occur in pre-made drawings, consult the troubleshooting section of the FP help file, located on the Options/help tab.

Join Locs to Aisle: Lines must be connected from each Location text insertion point to an aisle path line in order for the FP application to know how to get to, and from, that location. You can manually draw the line from the insertion point (make sure to use your object snap modes) to another aisle path line, or you can select this button and have those lines drawn for you.

When the FP application automatically creates “Join Lines” from each Location text to the aisle network it does so by selecting the closest aisle path line perpendicular, or end-point connection. Join lines are placed on a layer of the same name as the user-specified aisle path layer plus the following extension “-JOIN”. In this way, the FP application can easily remove these lines and recreate them as the Location points are moved around in the drawing by the user.

While you can use this “-JOIN” layer to manually draw connecting lines from the Location text to the aisle network, the program will remove these lines whenever the Erase Aisle Joins button is selected. As such, it is recommended that all manually joined Locations are created on the same layer in which the aisle path lines are drawn.

The “Join Locs” function will first check to see if the Location text is already joined to the aisle network, and will not add an automatic Join line if an existing line is found drawn to that insertion point.

In the case where multiple aisle path layers exist, the “Join Locs” command will only join Location text to an aisle path line on a particular layer if that location is referenced in a routing that uses a method that references a method type that is

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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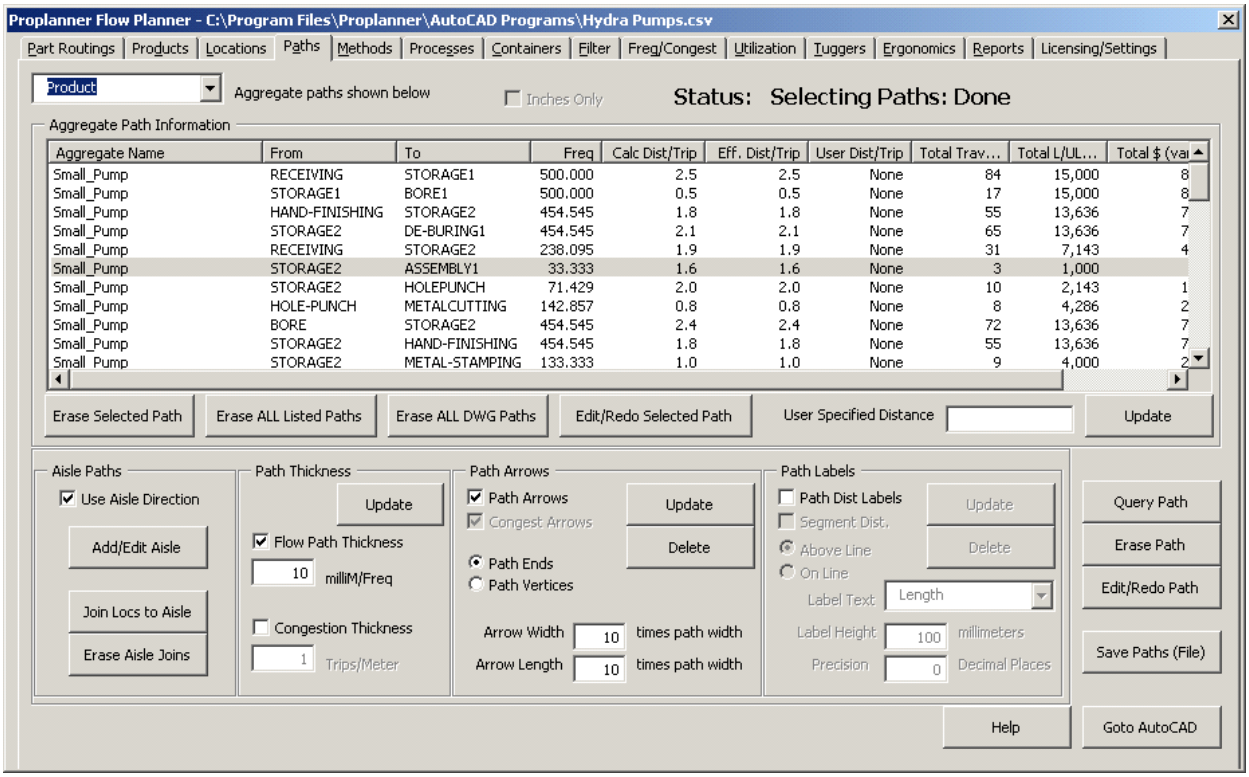
5.6.4 Path thickness


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

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User Specified Distance Update: For all selected paths you can specify a path

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Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

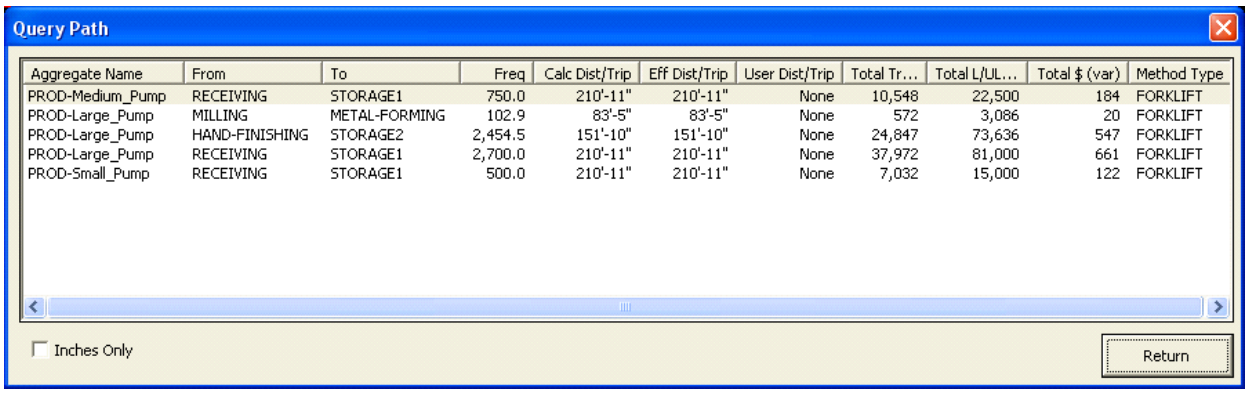
Erase All Listed Paths: Will erase all of the listed flow paths in the current drawing for the selected aggregation.

Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

Query Path: Hides the FP Modal window and allows you to select a flow path to query. Unlike the older versions of Flow Path, the user can now select multiple lines and must hit enter when done selecting the lines they wish to query. Then all the paths information will come up in the window below just like on the Paths tab.


Query Path
Aggregate Name From To Freq Calc Dist/Trip Eff Dist/Trip User Dist/Trip Total Tr... Total L/UL... Total $ (var) Method Type
PROD-Medium_Pump RECEIVING STORAGE1 750.0 210'-11" 210'-11" None 10,548 22,500 184 FORKLIFT
PROD-Large_Pump MILLING METAL-FORMING 102.9 83'-5" 83'-5" None 572 3,086 20 FORKLIFT
PROD-Large_Pump HAND-FINISHING STORAGE2 2,454.5 151'-10" 151'-10" None 24,847 73,636 547 FORKLIFT
PROD-Large_Pump RECEIVING STORAGE1 2,700.0 210'-11" 210'-11" None 37,972 81,000 661 FORKLIFT
PROD-Small_Pump RECEIVING STORAGE1 500.0 210'-11" 210'-11" None 7,032 15,000 122 FORKLIFT
Inches Only
Return

Erase Path: Will allow you to select a flow path in the drawing to erase.

Edit/Redo Path: Will allow you to select a flow path in the drawing to specify a manual route for.

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Save Paths (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of flow path distances to

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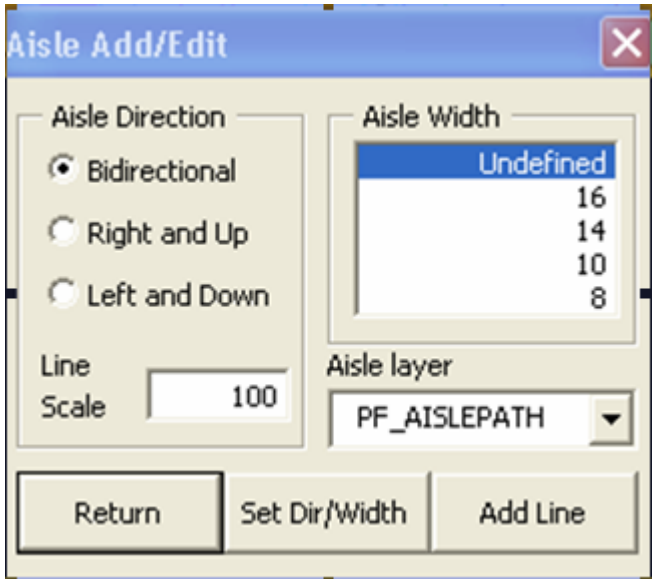

Incorrect Aisle Drawing: If the aisle paths are drawn incorrectly, this will cause the

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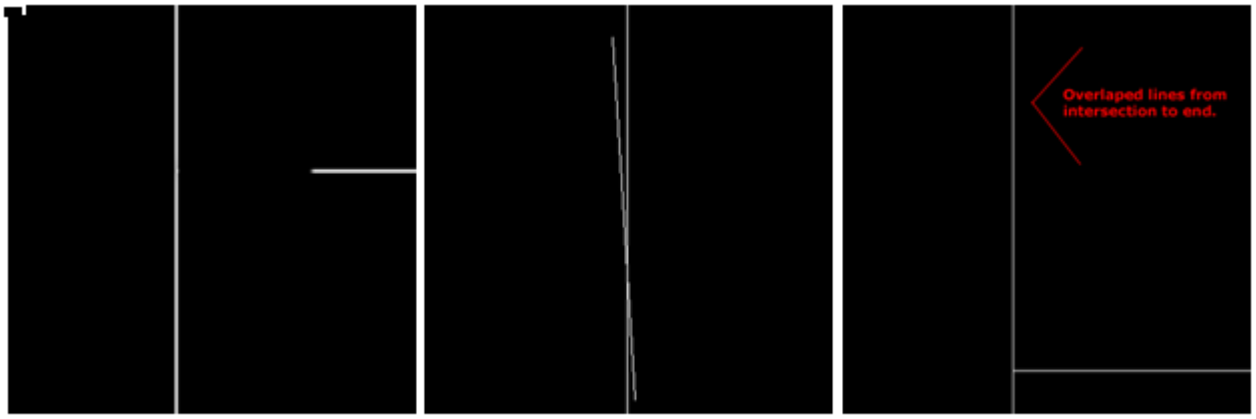
calculation to produce straight line flows. Below are examples of the most common ways to cause problems by incorrectly drawing aisle path lines.



Disconnected Lines Minute Crossovers Overlapping

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While you can use this “-JOIN” layer to manually draw connecting lines from the Location text to the aisle network, the program will remove these lines whenever the Erase Aisle Joins button is selected. As such, it is recommended that all manually joined Locations are created on the same layer in which the aisle path lines are drawn.

The “Join Locs” function will first check to see if the Location text is already joined to the aisle network, and will not add an automatic Join line if an existing line is found drawn to that insertion point.

In the case where multiple aisle path layers exist, the “Join Locs” command will only join Location text to an aisle path line on a particular layer if that location is referenced in a routing that uses a method that references a method type that is

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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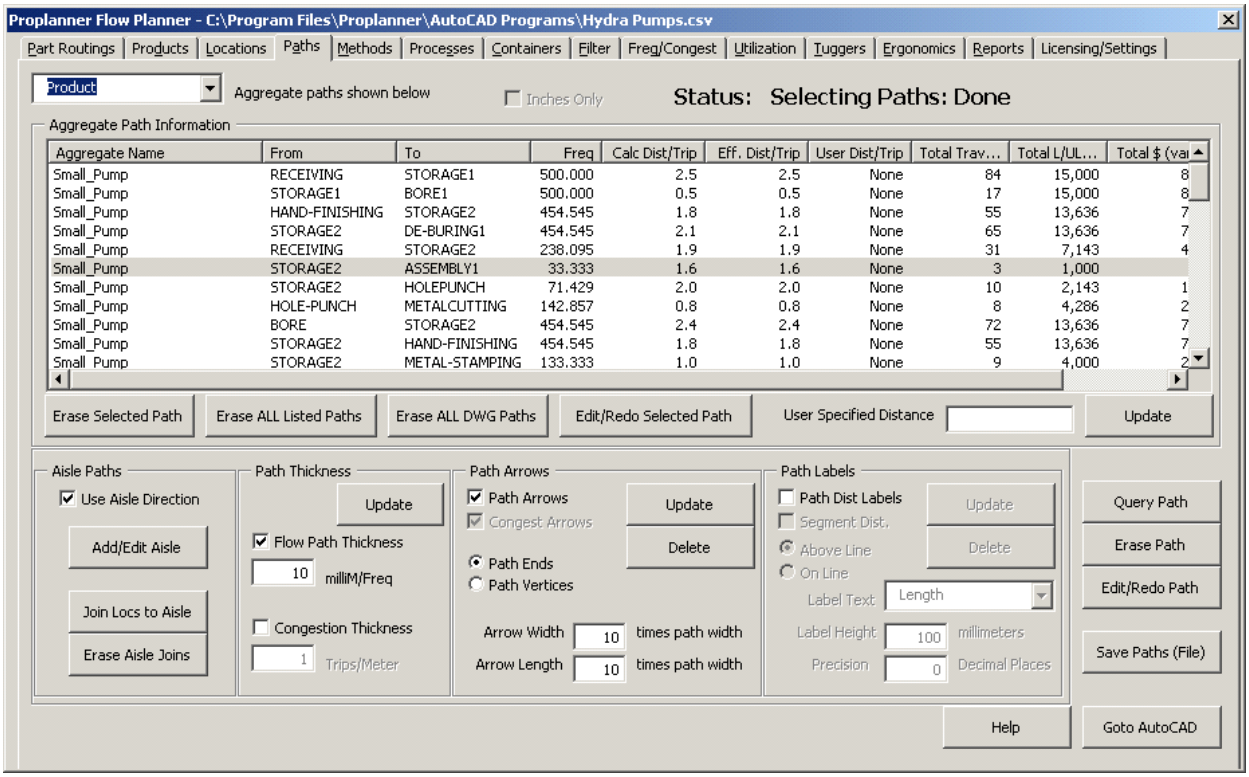
5.6.5 Path Arrows


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

The Paths tab is the main interface for path viewing, editing and annotation. The path list is filled from information embedded within the paths shown in the AutoCAD window for the selected aggregation method. Therefore, if there are no paths in AutoCAD for the selected aggregation, then no paths will be shown in the list view.

When you select an aggregation in the top-left pull-down list, the FP application will turn off all flow lines in the drawing and then turn on those flow lines for the selected aggregation and subsequently fill the list view with the information stored within those flow path polylines.

Since the information in the Paths window is pre-generated, it is not necessary to load the routing file and calculate it in order to view, query, filter, color code (via the Freq/Congest tab), delete or alter the thickness of the flow lines for all previously generated aggregations.

Aggregated Paths List Group

Aggregation Method: Selecting an aggregation method will filter the flow path lines in the drawing to only those for that method, and then the information within those lines will be displayed in the list view.

User Specified Distance Update: For all selected paths you can specify a path

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distance that will override the distance that the FP application computed from the drawing. This feature is useful for paths that may extend to other buildings, or locations not in the current drawing.

Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

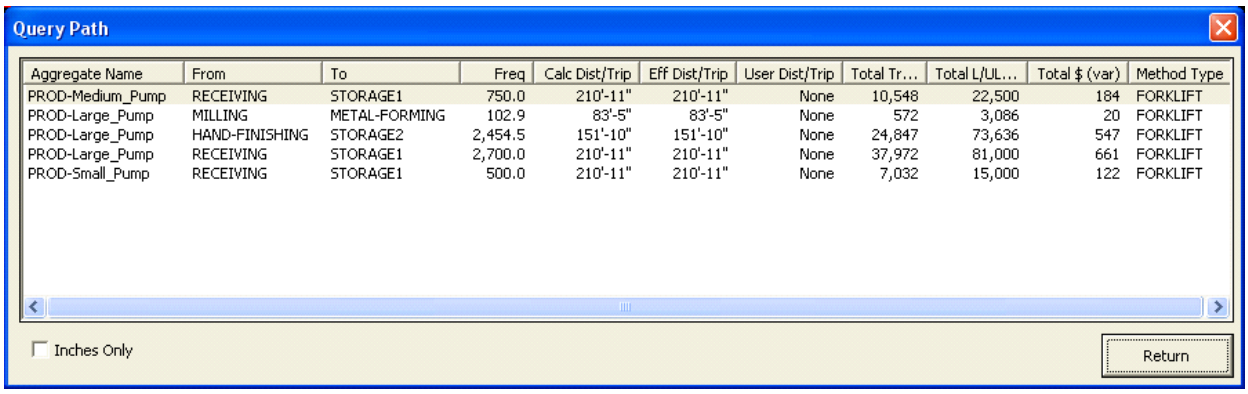
Erase All Listed Paths: Will erase all of the listed flow paths in the current drawing for the selected aggregation.

Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

Query Path: Hides the FP Modal window and allows you to select a flow path to query. Unlike the older versions of Flow Path, the user can now select multiple lines and must hit enter when done selecting the lines they wish to query. Then all the paths information will come up in the window below just like on the Paths tab.


Query Path
Aggregate Name From To Freq Calc Dist/Trip Eff Dist/Trip User Dist/Trip Total Tr... Total L/UL... Total $ (var) Method Type
PROD-Medium_Pump RECEIVING STORAGE1 750.0 210'-11" 210'-11" None 10,548 22,500 184 FORKLIFT
PROD-Large_Pump MILLING METAL-FORMING 102.9 83'-5" 83'-5" None 572 3,086 20 FORKLIFT
PROD-Large_Pump HAND-FINISHING STORAGE2 2,454.5 151'-10" 151'-10" None 24,847 73,636 547 FORKLIFT
PROD-Large_Pump RECEIVING STORAGE1 2,700.0 210'-11" 210'-11" None 37,972 81,000 661 FORKLIFT
PROD-Small_Pump RECEIVING STORAGE1 500.0 210'-11" 210'-11" None 7,032 15,000 122 FORKLIFT
Inches Only
Return

Erase Path: Will allow you to select a flow path in the drawing to erase.

Edit/Redo Path: Will allow you to select a flow path in the drawing to specify a manual route for.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. You can also execute any AutoCAD command on the menus or command line.

Save Paths (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of flow path distances to

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other applications. The FP application does not read this file.

Aisle Paths

The FP application can automatically generate flow path lines down the aisles of your factory drawing using a shortest path algorithm to find the best route. To perform this function, the FP application references a layer in AutoCAD that contains lines (not polylines) that show the valid routes. If these lines intersect, then the FP application assumes an intersection.

If the lines have the linetype of “BYLAYER” then those lines are assumed to represent bi-directional flows. Otherwise, if the line is labeled with “UR” then the line represents flow only in the direction of 0 to 179 degrees. If the line is labeled with “DL” then the line represents flow only in the direction of 180 to 359 degrees. Selecting the Add/Edit Aisle button will allow you to easily set these linetypes.

The FP application allows you to specify more than one layer for your aisle lines. You are then allowed to assign these layers to your Method Types so that you can specify a different set of aisles for Fork Trucks versus those for People or AGV’s (for example).

Use Aisle Direction: Allows you to create aisle path lines and edit the direction and width of existing aisle lines. You can only add lines on the layers specified in the pull-down list. These layers come from the specified layers for the method types in your current session. Therefore, if you wish to add a layer to draw aisle lines on, you will need to first add that layer to one of your Method types in the Methods tab.

Incorrect Aisle Drawing: If the aisle paths are drawn incorrectly, this will cause the

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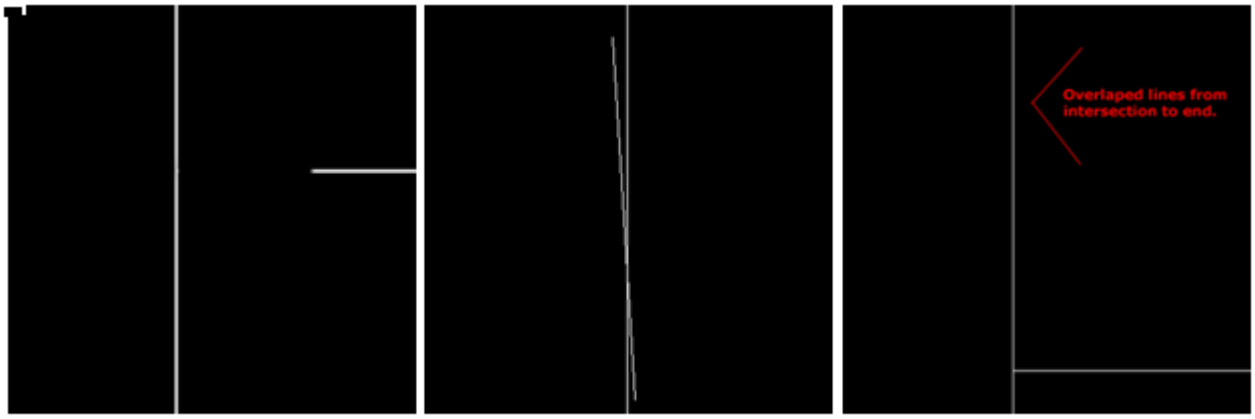
calculation to produce straight line flows. Below are examples of the most common ways to cause problems by incorrectly drawing aisle path lines.



Disconnected Lines Minute Crossovers Overlapping

Most of these errors are only viewable zoomed in or if you know where you overlapped. To avoid these issues, the best way is to try and draw the entire aisle network at once, instead of making many individual lines. If these issues occur in pre-made drawings, consult the troubleshooting section of the FP help file, located on the Options/help tab.

Join Locs to Aisle: Lines must be connected from each Location text insertion point to an aisle path line in order for the FP application to know how to get to, and from, that location. You can manually draw the line from the insertion point (make sure to use your object snap modes) to another aisle path line, or you can select this button and have those lines drawn for you.

When the FP application automatically creates “Join Lines” from each Location text to the aisle network it does so by selecting the closest aisle path line perpendicular, or end-point connection. Join lines are placed on a layer of the same name as the user-specified aisle path layer plus the following extension “-JOIN”. In this way, the FP application can easily remove these lines and recreate them as the Location points are moved around in the drawing by the user.

While you can use this “-JOIN” layer to manually draw connecting lines from the Location text to the aisle network, the program will remove these lines whenever the Erase Aisle Joins button is selected. As such, it is recommended that all manually joined Locations are created on the same layer in which the aisle path lines are drawn.

The “Join Locs” function will first check to see if the Location text is already joined to the aisle network, and will not add an automatic Join line if an existing line is found drawn to that insertion point.

In the case where multiple aisle path layers exist, the “Join Locs” command will only join Location text to an aisle path line on a particular layer if that location is referenced in a routing that uses a method that references a method type that is

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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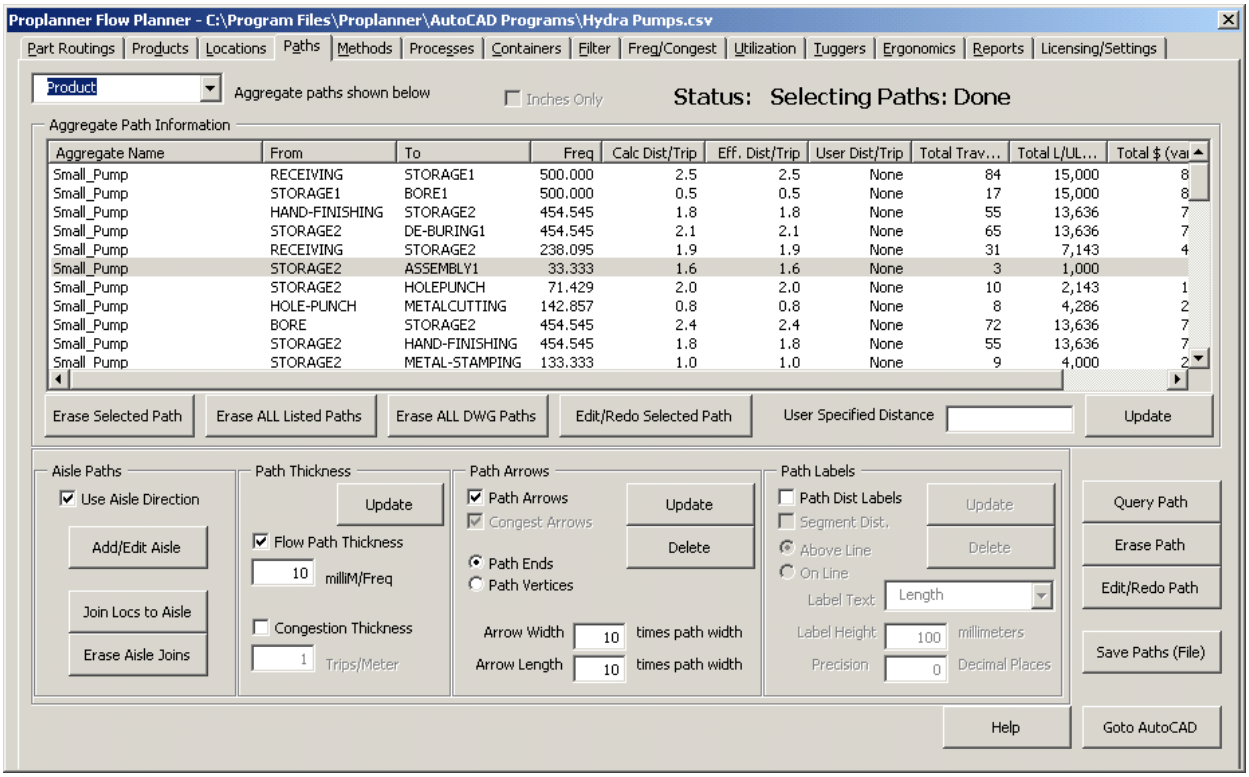
5.6.6 Path labels


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Tuggers
Ergonomics
Reports
Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Path Information
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 2.5 | 2.5 | None | 84 | 15,000 | 8
Small_Pump | STORAGE1 | BORE1 | 500.000 | 0.5 | 0.5 | None | 17 | 15,000 | 8
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 2.1 | 2.1 | None | 65 | 13,636 | 7
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 1.9 | 1.9 | None | 31 | 7,143 | 4
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 1.6 | 1.6 | None | 3 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 2.0 | 2.0 | None | 10 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 0.8 | 0.8 | None | 8 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 2.4 | 2.4 | None | 72 | 13,636 | 7
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 1.8 | 1.8 | None | 55 | 13,636 | 7
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 1.0 | 1.0 | None | 9 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
10
milliM/Freq
Congestion Thickness
1
Trips/Meter
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
10
times path width
Arrow Length
10
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
100
millimeters
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

The Paths tab is the main interface for path viewing, editing and annotation. The path list is filled from information embedded within the paths shown in the AutoCAD window for the selected aggregation method. Therefore, if there are no paths in AutoCAD for the selected aggregation, then no paths will be shown in the list view.

When you select an aggregation in the top-left pull-down list, the FP application will turn off all flow lines in the drawing and then turn on those flow lines for the selected aggregation and subsequently fill the list view with the information stored within those flow path polylines.

Since the information in the Paths window is pre-generated, it is not necessary to load the routing file and calculate it in order to view, query, filter, color code (via the Freq/Congest tab), delete or alter the thickness of the flow lines for all previously generated aggregations.

Aggregated Paths List Group

Aggregation Method: Selecting an aggregation method will filter the flow path lines in the drawing to only those for that method, and then the information within those lines will be displayed in the list view.

User Specified Distance Update: For all selected paths you can specify a path

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distance that will override the distance that the FP application computed from the drawing. This feature is useful for paths that may extend to other buildings, or locations not in the current drawing.

Erase Selected Paths: Will erase the selected flow path in the current drawing and the list view.

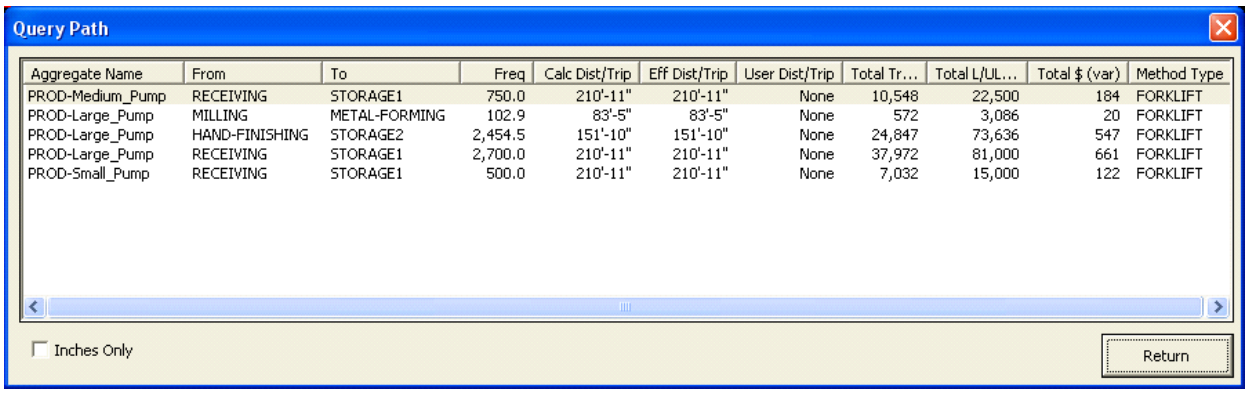
Erase All Listed Paths: Will erase all of the listed flow paths in the current drawing for the selected aggregation.

Erase All DWG Paths: Will erase all of the flow paths in the current drawing for the selected aggregation.

Edit/Redo Selected Path: Will allow you to specify a manually generated flow path line for the selected path.

Editing Commands in Bottom right of screen

Query Path: Hides the FP Modal window and allows you to select a flow path to query. Unlike the older versions of Flow Path, the user can now select multiple lines and must hit enter when done selecting the lines they wish to query. Then all the paths information will come up in the window below just like on the Paths tab.


Query Path
Aggregate Name From To Freq Calc Dist/Trip Eff Dist/Trip User Dist/Trip Total Tr... Total L/UL... Total $ (var) Method Type
PROD-Medium_Pump RECEIVING STORAGE1 750.0 210'-11" 210'-11" None 10,548 22,500 184 FORKLIFT
PROD-Large_Pump MILLING METAL-FORMING 102.9 83'-5" 83'-5" None 572 3,086 20 FORKLIFT
PROD-Large_Pump HAND-FINISHING STORAGE2 2,454.5 151'-10" 151'-10" None 24,847 73,636 547 FORKLIFT
PROD-Large_Pump RECEIVING STORAGE1 2,700.0 210'-11" 210'-11" None 37,972 81,000 661 FORKLIFT
PROD-Small_Pump RECEIVING STORAGE1 500.0 210'-11" 210'-11" None 7,032 15,000 122 FORKLIFT
Inches Only
Return

Erase Path: Will allow you to select a flow path in the drawing to erase.

Edit/Redo Path: Will allow you to select a flow path in the drawing to specify a manual route for.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. You can also execute any AutoCAD command on the menus or command line.

Save Paths (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of flow path distances to

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other applications. The FP application does not read this file.

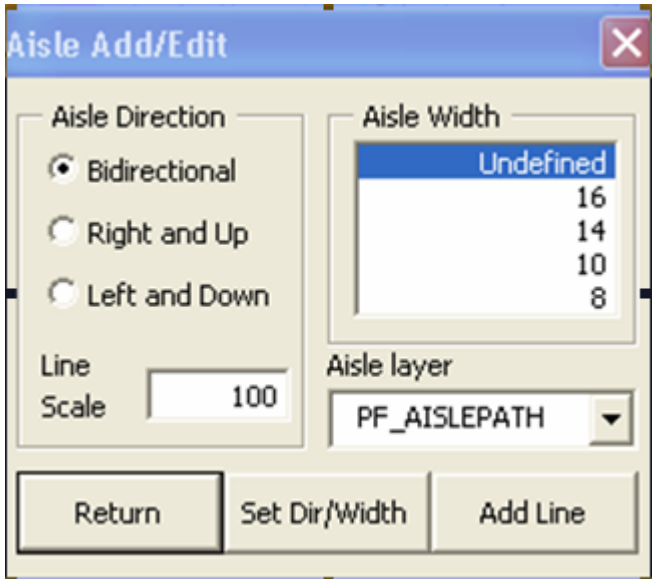
Aisle Paths

The FP application can automatically generate flow path lines down the aisles of your factory drawing using a shortest path algorithm to find the best route. To perform this function, the FP application references a layer in AutoCAD that contains lines (not polylines) that show the valid routes. If these lines intersect, then the FP application assumes an intersection.

If the lines have the linetype of “BYLAYER” then those lines are assumed to represent bi-directional flows. Otherwise, if the line is labeled with “UR” then the line represents flow only in the direction of 0 to 179 degrees. If the line is labeled with “DL” then the line represents flow only in the direction of 180 to 359 degrees. Selecting the Add/Edit Aisle button will allow you to easily set these linetypes.

The FP application allows you to specify more than one layer for your aisle lines. You are then allowed to assign these layers to your Method Types so that you can specify a different set of aisles for Fork Trucks versus those for People or AGV’s (for example).

Use Aisle Direction: Allows you to create aisle path lines and edit the direction and width of existing aisle lines. You can only add lines on the layers specified in the pull-down list. These layers come from the specified layers for the method types in your current session. Therefore, if you wish to add a layer to draw aisle lines on, you will need to first add that layer to one of your Method types in the Methods tab.



Incorrect Aisle Drawing: If the aisle paths are drawn incorrectly, this will cause the

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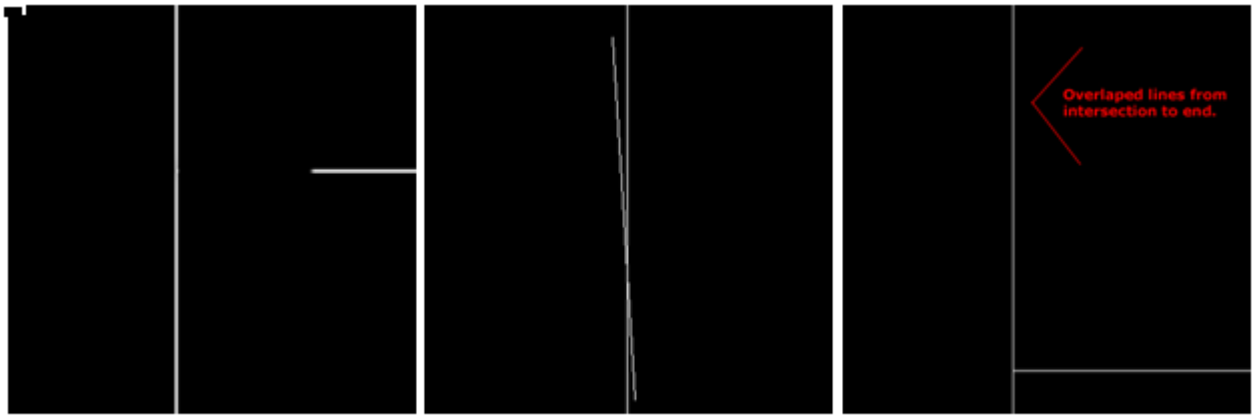
calculation to produce straight line flows. Below are examples of the most common ways to cause problems by incorrectly drawing aisle path lines.



Disconnected Lines Minute Crossovers Overlapping

Most of these errors are only viewable zoomed in or if you know where you overlapped. To avoid these issues, the best way is to try and draw the entire aisle network at once, instead of making many individual lines. If these issues occur in pre-made drawings, consult the troubleshooting section of the FP help file, located on the Options/help tab.

Join Locs to Aisle: Lines must be connected from each Location text insertion point to an aisle path line in order for the FP application to know how to get to, and from, that location. You can manually draw the line from the insertion point (make sure to use your object snap modes) to another aisle path line, or you can select this button and have those lines drawn for you.

When the FP application automatically creates “Join Lines” from each Location text to the aisle network it does so by selecting the closest aisle path line perpendicular, or end-point connection. Join lines are placed on a layer of the same name as the user-specified aisle path layer plus the following extension “-JOIN”. In this way, the FP application can easily remove these lines and recreate them as the Location points are moved around in the drawing by the user.

While you can use this “-JOIN” layer to manually draw connecting lines from the Location text to the aisle network, the program will remove these lines whenever the Erase Aisle Joins button is selected. As such, it is recommended that all manually joined Locations are created on the same layer in which the aisle path lines are drawn.

The “Join Locs” function will first check to see if the Location text is already joined to the aisle network, and will not add an automatic Join line if an existing line is found drawn to that insertion point.

In the case where multiple aisle path layers exist, the “Join Locs” command will only join Location text to an aisle path line on a particular layer if that location is referenced in a routing that uses a method that references a method type that is

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mapped to that layer.

Erase Aisle Joins: Will remove all lines found on the Aisle Path Join Layer (the name of the aisle path layer with a "-JOIN" suffix)

Path Thickness

Flow Path Thickness: Allows you to specify a scale factor for the flow line path thickness. Selecting update will apply this scale factor to the flow path lines for the selected aggregation.

Congestion Thickness: Allows you to specify a scale factor for the congestion flow lines. Selecting update will apply this scale factor to the congestion lines.

Path Arrows

Delete: Deletes all arrows in the selected aggregation.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Segment Dist.: Includes the distance of the individual segment with the path label.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

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Label Text: Determines if the path label will be Length, Aggregate, From/To, Frequency, and Method Type.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

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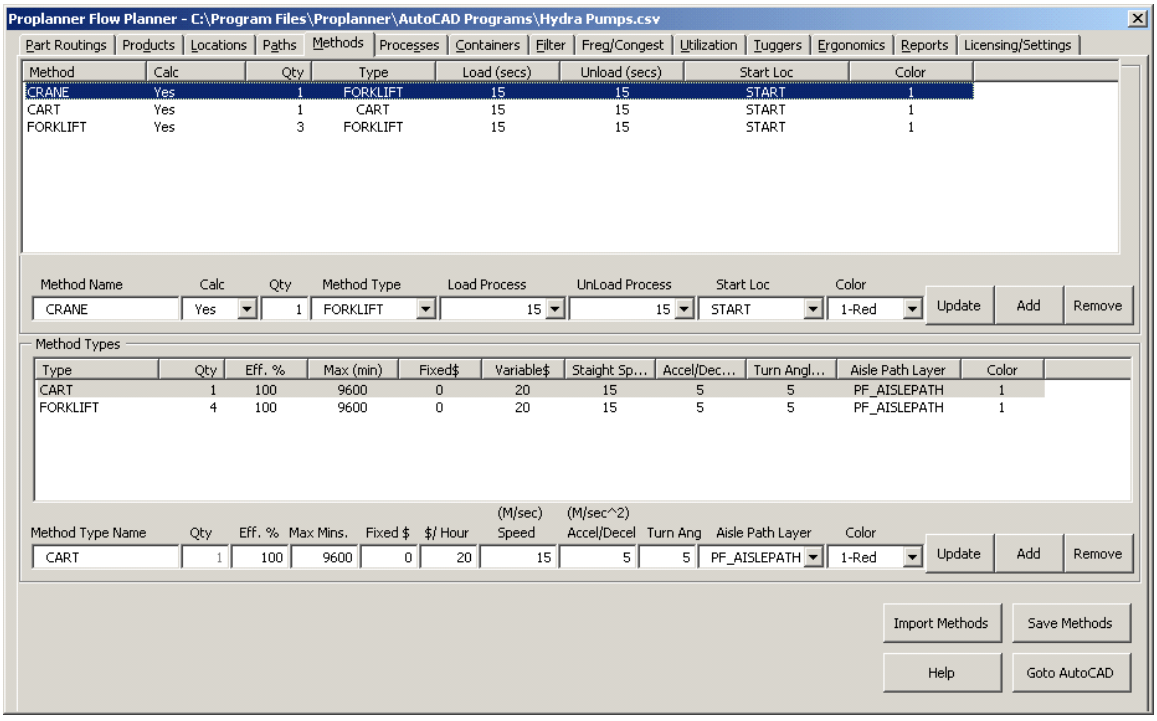
5.7 Methods Tab



Methods are used to determine the time and cost of a flow routing. The methods tab contains both a list of Methods and a list of Method types. A Method must reference a specific Method Type. The user can set a quantity for method. Method type quantities are automatically calculated by summing up all referenced method quantities (Note that the method type quantity may not be correct until *calculation* button in the *Part Routing* Tab is hit). Quantities for both methods and method types can be fractional or whole. This allows the user to get more exact numbers for output and later round it to whole numbers representing a whole cart or forklift, as desired.

Methods are device instances (specific devices) or device usage types (specific load and unload combinations), while Method Types are classes of devices with performance and cost information. In the example shown above, the CART is a method with a 5 second load and unload time that uses the performance and cost properties of the method type HAND. A flow routing would reference the method

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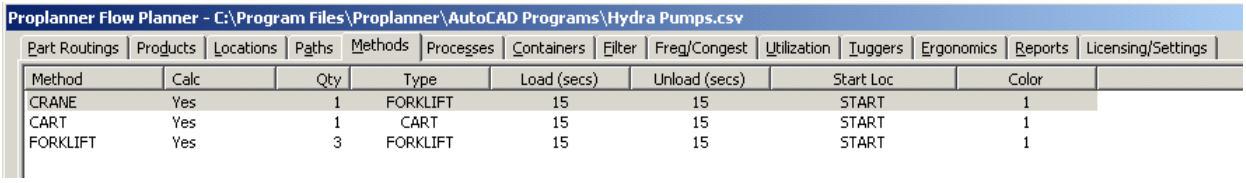
CART which would have the performance of the Method Type HAND.

Methods Format



Method	Calc	Qty	Type	Load (secs)	Unload (secs)	Start Loc	Color
CRANE	Yes	1	FORKLIFT	15	15	START	1
CART	Yes	1	CART	15	15	START	1
FORKLIFT	Yes	3	FORKLIFT	15	15	START	1

Method Name: Name of a method referenced in the routing file. Changing this name and selecting the Update button will search and replace all occurrences of that method within the routing file.

Calc: For large studies, you may wish to turn off the calculation of certain method types when they are not the focus of a particular study.

The congestion diagram is generated for all Products and Methods that have their Calc option selected to YES. As a result, if you wish to generate a congestion analysis for a subset of Products and/or material handling methods, then you need only de-select (by setting the calc option to NO), those Products and/or methods that you do not wish included in your congestion analysis.

Qty: Quantity of the Method.

Method Type: Name of method type (discussed below) to use the performance data and aisle network for.

Load & Unload: Determines the time (in seconds) for the Load or Unload activity. Times can be specified directly, or the name of a Process (located in the process tab) can be referenced. If there is a load/unload time specified on the routings tab for a specific route, that time will override this value automatically.

Start Loc: Sets the default starting location for material handling device objects in the flow animation (coming with a future release).

Color: Color for the Method Type when Aggregate by Method Type is selected.

Method Types Format

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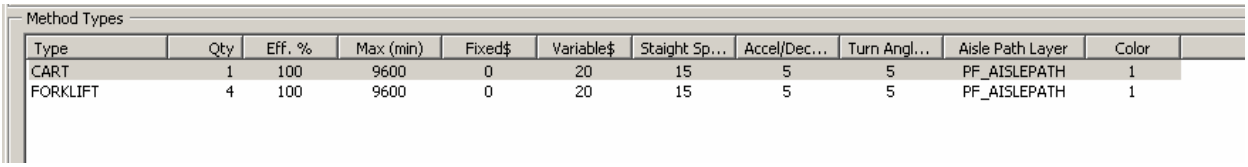
Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
FORKLIFT	4	100	9600	0	20	15	5	5	PF_AISLEPATH	1

Method Type Name: Name of a Method Type referenced in the Method list. Changing this name and selecting the Update button will search and replace all occurrences of that method type within the method list file.

Quantity: Quantity of Method Types. Used to determine the total fixed costs for the Method Type.

Effective %: (1 to 100) Typically, the routings file contains only productive moves of material, however method types will need to deadhead (move empty to another pickup location) a certain percentage of the time. The effective percentage is the time that the device typically travels loaded (accounted for in the routings) divided by the total travel time (including loaded and empty-deadheading). If all moves of the Method Type are accounted for in the routing, then set this value to 100, otherwise, if only productive moves are accounted for in the routing and the device will typically return back empty, then set this value to 50.

Maximum Minutes: The maximum minutes per time period (same as that which the Product Quantity is determined for) that the device is available. 115200 minutes is the default, which is equivalent to 1 shift, full-time operation.

Fixed Cost $: The fixed cost per time period (same as that for the Product Quantity). This value is multiplied by the total Quantity of Method Types and then added to the total handling cost in the summary report.

Variable Cost $: The variable cost per hour for use of the method type. This value is multiplied by the time of usage for the method type.

Straight Speed: Straight moving speed for the Method Type.

Acceleration/Deceleration: Rate of Acceleration and Deceleration for the method type. This is used to slow down and speed up the device around corners. As a result, a 100' straight move will take less time (and thus be cheaper), than a 100' move would be that turns several times.

Turn Angle: An integer value in degrees that determines if an angle between two path segments (lines) constitutes a turn that the method type would need to slow down and speed up for. The default value of 100 degrees means that any angle less then or equal to 100 degrees would be considered a turn.

Aisle Path Layer: Identifies the layer in the AutoCAD drawing to look in for the Aisle Path lines used by the method type. Each method type could use a different layer so that different aisle networks can be specified (i.e. different aisles may be used by Fork Trucks, Tugger Trucks, AGV's and People).

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Color: Selects which aggregate flow paths to change the color coding for.

Editing

Update: Changes to the Method or Method Type names will be automatically made in the Routings and Method lists that reference that Method or Method Type.

Remove: Methods and Method Types cannot be removed if they are currently being referenced in the routing or Method respectively.

Add: Adding a Method, or Method Type, will display it in the:

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Method Type - Load and Unload pull-down lists on the Methods tab.

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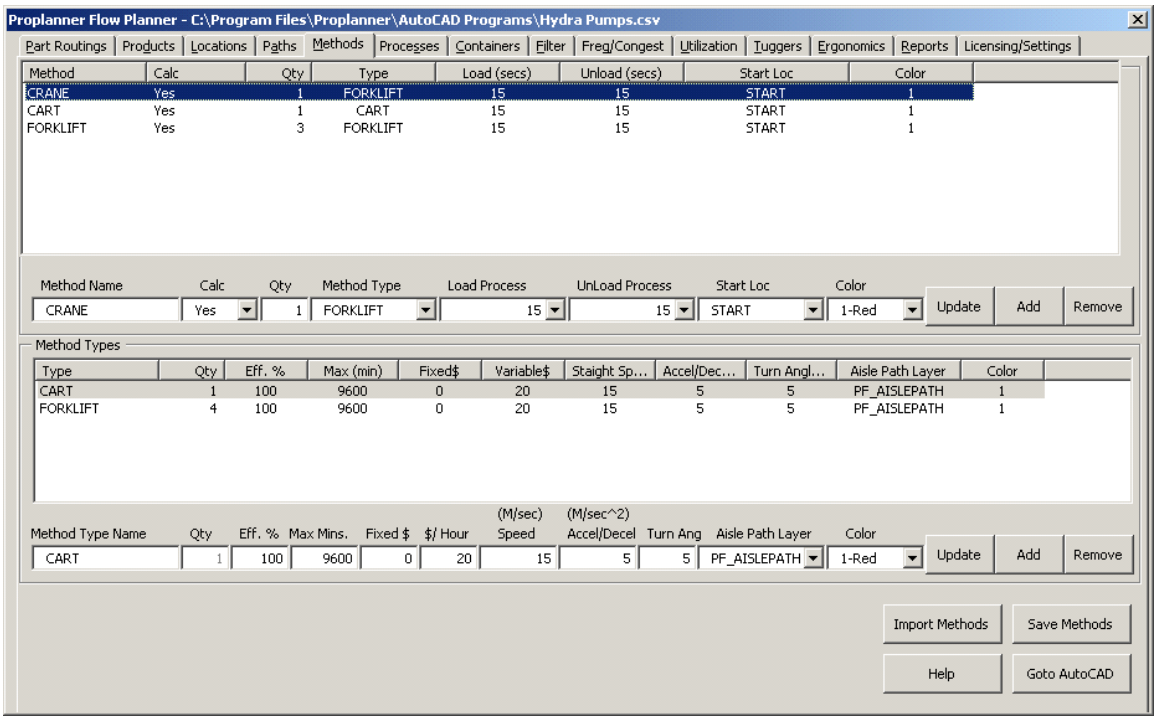
5.7.1 Methods format



Methods are used to determine the time and cost of a flow routing. The methods tab contains both a list of Methods and a list of Method types. A Method must reference a specific Method Type. The user can set a quantity for method. Method type quantities are automatically calculated by summing up all referenced method quantities (Note that the method type quantity may not be correct until *calculation* button in the *Part Routing* Tab is hit). Quantities for both methods and method types can be fractional or whole. This allows the user to get more exact numbers for output and later round it to whole numbers representing a whole cart or forklift, as desired.

Methods are device instances (specific devices) or device usage types (specific load and unload combinations), while Method Types are classes of devices with performance and cost information. In the example shown above, the CART is a method with a 5 second load and unload time that uses the performance and cost properties of the method type HAND. A flow routing would reference the method

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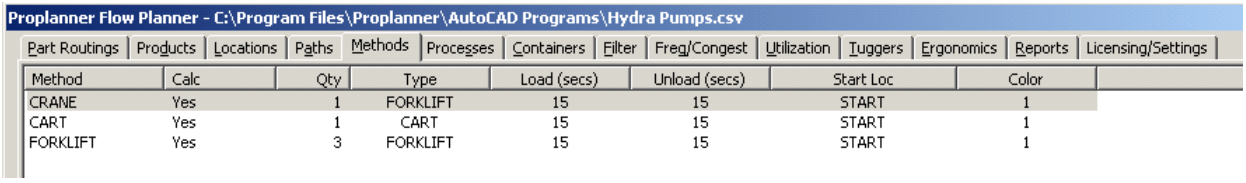
CART which would have the performance of the Method Type HAND.

Methods Format



Method	Calc	Qty	Type	Load (secs)	Unload (secs)	Start Loc	Color
CRANE	Yes	1	FORKLIFT	15	15	START	1
CART	Yes	1	CART	15	15	START	1
FORKLIFT	Yes	3	FORKLIFT	15	15	START	1

Method Name: Name of a method referenced in the routing file. Changing this name and selecting the Update button will search and replace all occurrences of that method within the routing file.

Calc: For large studies, you may wish to turn off the calculation of certain method types when they are not the focus of a particular study.

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Qty: Quantity of the Method.

Method Type: Name of method type (discussed below) to use the performance data and aisle network for.

Load & Unload: Determines the time (in seconds) for the Load or Unload activity. Times can be specified directly, or the name of a Process (located in the process tab) can be referenced. If there is a load/unload time specified on the routings tab for a specific route, that time will override this value automatically.

Start Loc: Sets the default starting location for material handling device objects in the flow animation (coming with a future release).

Color: Color for the Method Type when Aggregate by Method Type is selected.

Method Types Format

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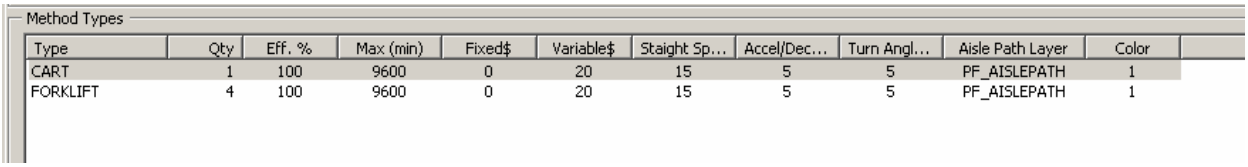
Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
FORKLIFT	4	100	9600	0	20	15	5	5	PF_AISLEPATH	1

Method Type Name: Name of a Method Type referenced in the Method list. Changing this name and selecting the Update button will search and replace all occurrences of that method type within the method list file.

Quantity: Quantity of Method Types. Used to determine the total fixed costs for the Method Type.

Effective %: (1 to 100) Typically, the routings file contains only productive moves of material, however method types will need to deadhead (move empty to another pickup location) a certain percentage of the time. The effective percentage is the time that the device typically travels loaded (accounted for in the routings) divided by the total travel time (including loaded and empty-deadheading). If all moves of the Method Type are accounted for in the routing, then set this value to 100, otherwise, if only productive moves are accounted for in the routing and the device will typically return back empty, then set this value to 50.

Maximum Minutes: The maximum minutes per time period (same as that which the Product Quantity is determined for) that the device is available. 115200 minutes is the default, which is equivalent to 1 shift, full-time operation.

Fixed Cost $: The fixed cost per time period (same as that for the Product Quantity). This value is multiplied by the total Quantity of Method Types and then added to the total handling cost in the summary report.

Variable Cost $: The variable cost per hour for use of the method type. This value is multiplied by the time of usage for the method type.

Straight Speed: Straight moving speed for the Method Type.

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Aisle Path Layer: Identifies the layer in the AutoCAD drawing to look in for the Aisle Path lines used by the method type. Each method type could use a different layer so that different aisle networks can be specified (i.e. different aisles may be used by Fork Trucks, Tugger Trucks, AGV's and People).

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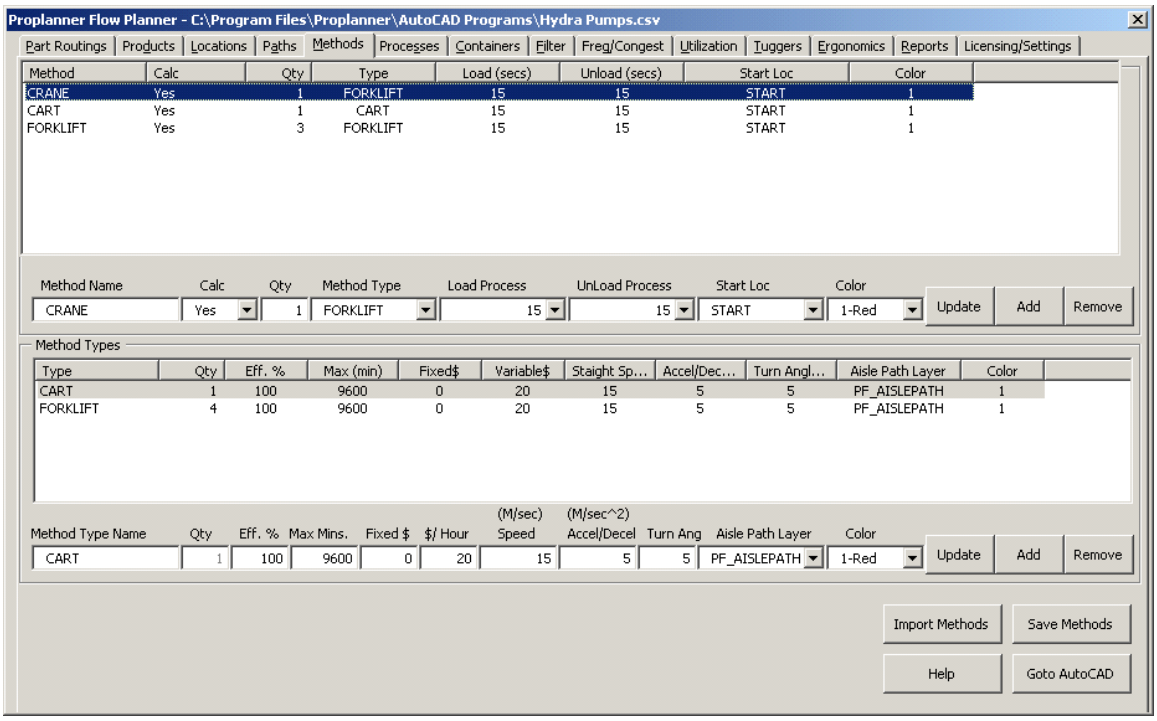
5.7.2 Method type's format



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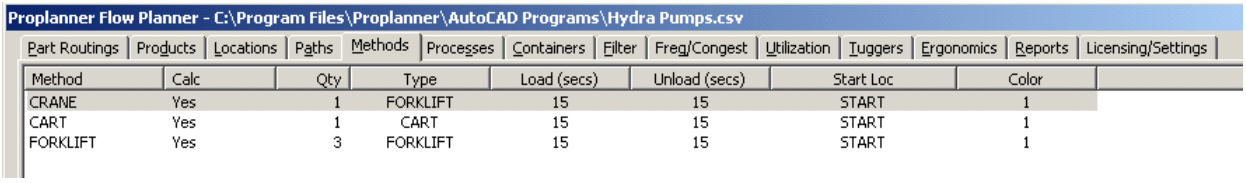

Method	Calc	Qty	Type	Load (secs)	Unload (secs)	Start Loc	Color
CRANE	Yes	1	FORKLIFT	15	15	START	1
CART	Yes	1	CART	15	15	START	1
FORKLIFT	Yes	3	FORKLIFT	15	15	START	1

Method Name: Name of a method referenced in the routing file. Changing this name and selecting the Update button will search and replace all occurrences of that method within the routing file.

Calc: For large studies, you may wish to turn off the calculation of certain method types when they are not the focus of a particular study.

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Qty: Quantity of the Method.

Method Type: Name of method type (discussed below) to use the performance data and aisle network for.

Load & Unload: Determines the time (in seconds) for the Load or Unload activity. Times can be specified directly, or the name of a Process (located in the process tab) can be referenced. If there is a load/unload time specified on the routings tab for a specific route, that time will override this value automatically.

Start Loc: Sets the default starting location for material handling device objects in the flow animation (coming with a future release).

Color: Color for the Method Type when Aggregate by Method Type is selected.

Method Types Format

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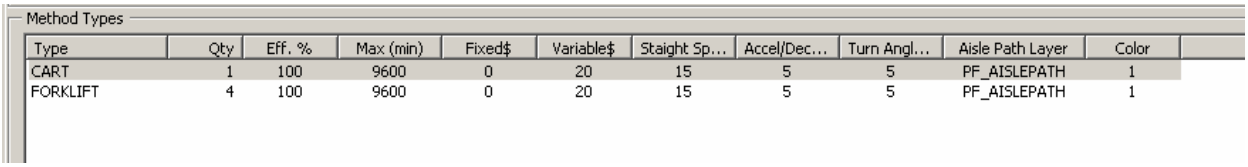
Method Types

Type	Qty	Eff. %	Max (min)	Fixed$	Variable$	Staight Sp...	Accel/Dec...	Turn Angl...	Aisle Path Layer	Color
CART	1	100	9600	0	20	15	5	5	PF_AISLEPATH	1
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Maximum Minutes: The maximum minutes per time period (same as that which the Product Quantity is determined for) that the device is available. 115200 minutes is the default, which is equivalent to 1 shift, full-time operation.

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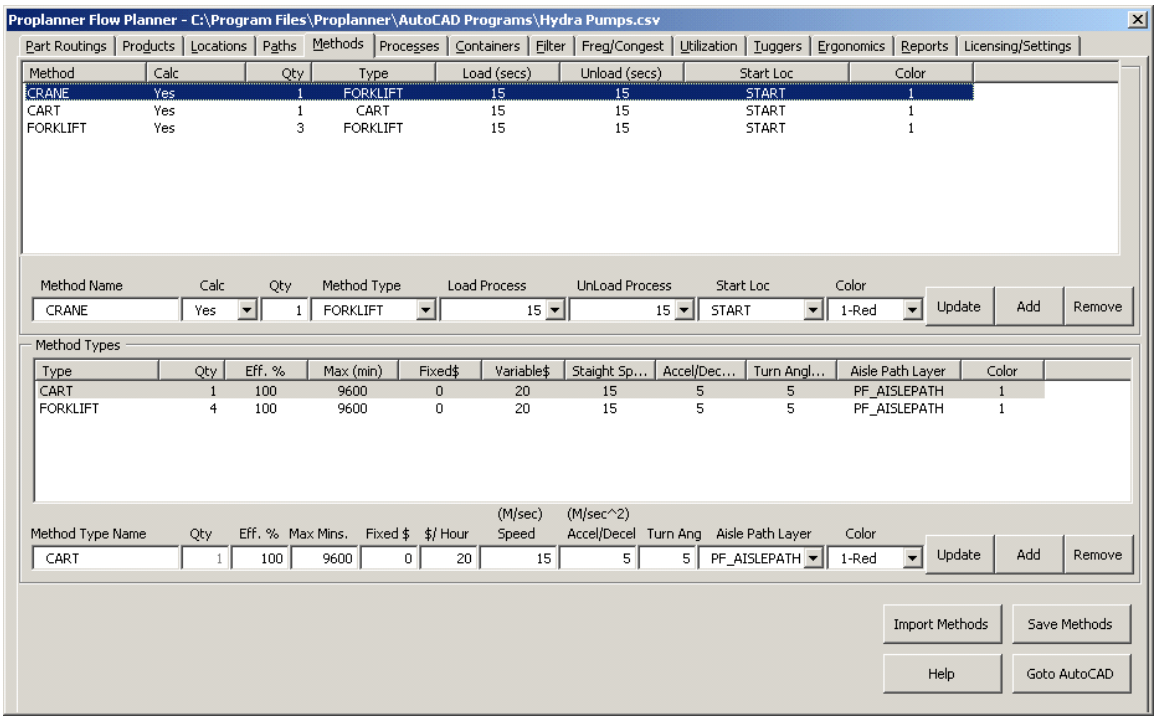
5.7.3 Editing



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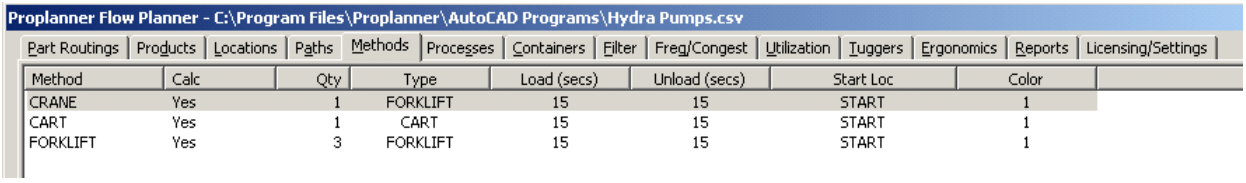

Method	Calc	Qty	Type	Load (secs)	Unload (secs)	Start Loc	Color
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CART	Yes	1	CART	15	15	START	1
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Color: Color for the Method Type when Aggregate by Method Type is selected.

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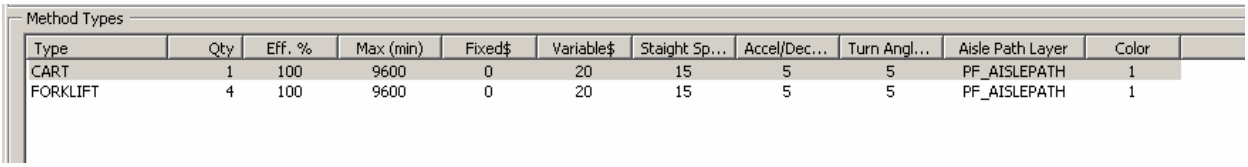
Method Types

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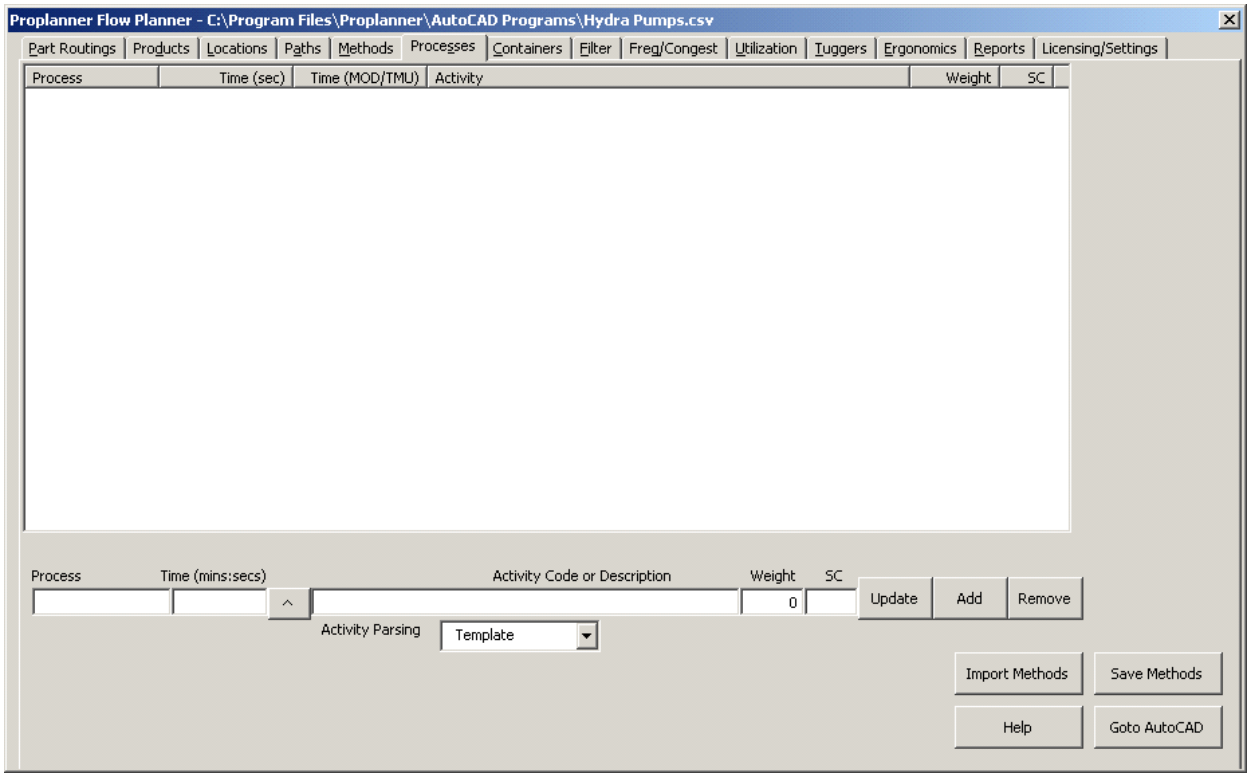
5.8 Processes Tab



Processes are used by Methods to define the Load and Unload time for each trip of that Method. While load times can be specified directly in the Load and/or Unload fields for a method, it may be more descriptive to include a reference to a process that has a specific time defined.

You can specify a time directly in a process or you can define a process time using a predetermined time system, such as Modapts, MTM-1, MTM-2, MTM-B, 4M, MTM-UAS or Most (Note: MTM-1, MTM-2, MTM-UAS and 4M are available to MTM association members only. Consult www.mtm.org or your Proplanner representative for more information).

When using a predetermined time system, simply enter the time codes in the Activity Code field (and optionally the special codes field [SC]). Then, select the Activity Parsing system that you wish to use (i.e. Modapts, MTM-B, etc) and select the Add or Update buttons. Your time codes will be parsed and a MOD or MU quantity, in addition to seconds, will be computed automatically by the FP application. The computed time will be displayed in the time field directly next to the Process name. This is the actual time that the application will use for the Load and/or Unload tasks. For syntax specifics regarding the use of predetermined time systems in Proplanner, please consult the Proplanner Predetermined Time Systems Parser guide (available from your Proplanner representative).

When using the "Template" method, the application will automatically determine each route's appropriate Load and/or Unload time based upon the template settings

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(described below). **In this case, the time displayed next to the Process name should be given a value of -1, to tell the application that it needs to re-compute the time for each individual route.**

Update: Changes to the container name will be automatically made in the routings that reference that container.

Remove: Processes cannot be removed if they are currently being referenced in the routing.

Add: Adding a process will display it in the Load and Unload pull-down lists on the Methods tab.

Import Methods: The methods file contains information about Containers, Methods, Method Types and Processes. Selecting the Import option will reload all three lists in their appropriate tabs.

Save Methods: The methods file contains information about Containers, Methods, Method Types and Processes. Selecting the Save option will save all three lists from their appropriate tabs

Activity Parsing "Template": The purpose of this Activity Parsing setting is to allow the user to set process times specific to container groups and to/from location groups that can vary from route to route. The user can even get so specific as to designate times for empty or full containers or locations. Below are details on how this works.

There are 5 different codes

BT – Base time

CF – Container that is full

CE – Container that is empty

CX – container that is full or empty

LF – Location for full container

LE – Location for empty container

LX – Location for full or empty containers

Since Processes are mapped to a Method's Load or Unload field, you need to create a naming convention for your processes so that you know which rules (i.e processes) apply to which methods, as well as to either load or unload processes of those methods. The Load process for a Method will always be used at the Route's From location, and the Unload process for a method will always be used for the Route's To Location (of course the program understands what is From and To if Via locations are also used).

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Containers are assumed full unless they have an asterisk in front of their name, as specified in the route line. So a container called TUB would be full, however a container called *TUB would be considered empty.

Multiple rules can be used in one process activity and their impact will be additive. Rules are parsed from left to right. Times specified in the rules can be positive or negative. Only one container (or container group) name can be specified within each individual rule, at this time. Likewise only one Location (or location group name) can be specified. As such, rules that apply to multiple containers or locations need to use groups.

The syntax for the 5 different codes is shown below.

The base time code has only two parameters

BT(6/9) – Base time of 6 seconds plus a time of 9 seconds per container

BT(6/0) – Base time of 6 seconds with no additional time per container

BT(0/5) – Base time of 0 seconds with an additional 5 seconds per container

The CF, CE, CX, LF, LE and LX codes have the prior two parameters, plus an Include/Exclude parameter and a Location/Container name (or group name) parameter

CF, CE or CX (depending on if the rule applies to a full, empty container, or both containers (thus both rules may be specified in one activity since only one will ever be true at a time)

Examples:

CF(6/9/I/TUB) – base time of 6 seconds plus a time of 9 seconds per container and this only applies for the container name (or group name) TUB. The “I” means inclusive for the container (or group) TUB. If an “E” was specified where the “I” is, then this would apply to all containers (or container groups) EXCEPT the TUB.

LF, LE or LX (depending on if the rule applies to a full or empty container at the specified location (thus both rules may be specified in one activity since only one will ever be true at a time)

LF(6/9/I/ASSEMBLY) – base time of 6 seconds plus a time of 9 seconds per container and this only applies if the route is at the location (or location group name)

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ASSEMBLY. The “I” means inclusive for the location (or location group) ASSEMBLY. If an “E” was specified where the “I” is, then this would apply to all locations (or location groups) EXCEPT ASSEMBLY.

Additive Example:

BT(0/4) CF(3/0/I/TUB) CE(1/1/I/TUB) LE(-2/0/E/DOCK) - A base time of 4 seconds per container, plus a time of 3 seconds if a Full TUB or a time of 1 second plus 1 second per container if an Empty tub, minus a time of 2 seconds for all locations EXCEPT the DOCK if the container is empty. All of the 5 codes are optional (you don’t need to specify a base time).

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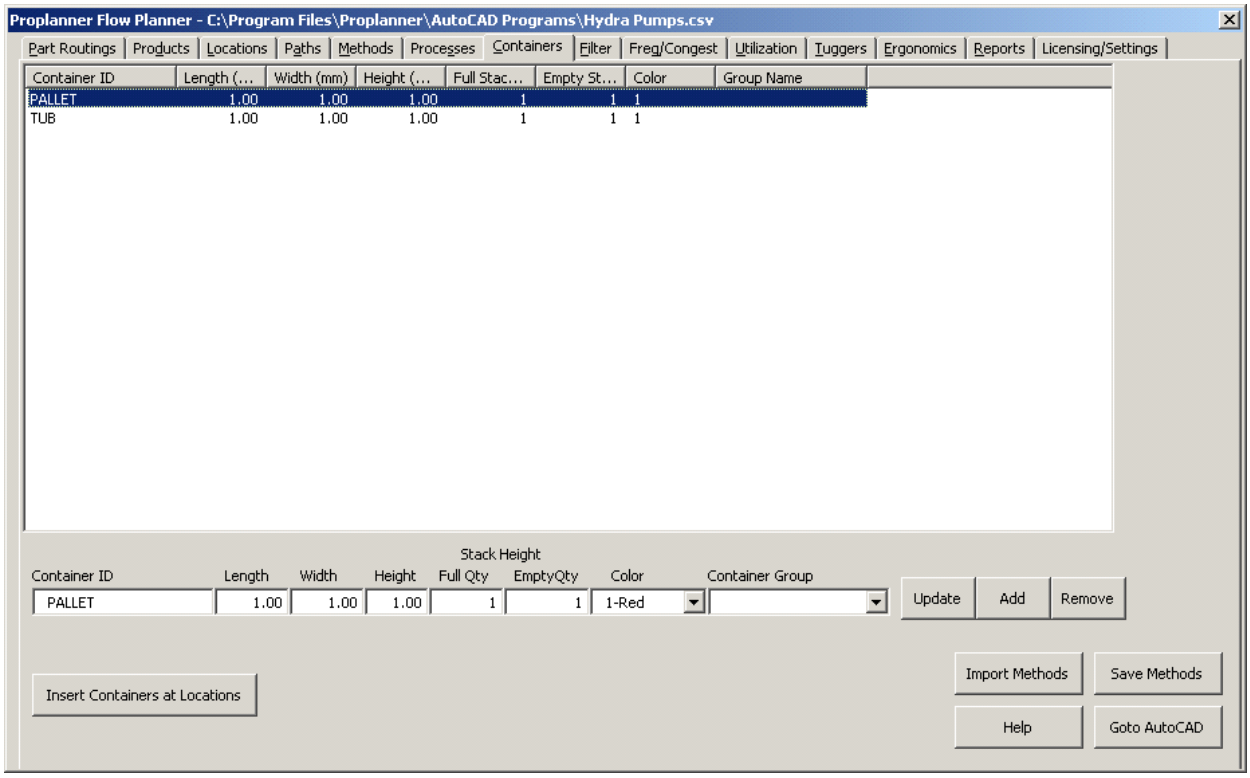
5.9 Containers Tab



When containers are specified in the routing, they will automatically appear on the container list in the Containers tab. Containers have length, width and height which are used in the tugger add-on to estimate containers/trip when creating mixed pallet routes. In addition, the width of the container is optionally used by the congestion feature to factor additional congestion frequency if the container width is equal to, or greater than, a specified percentage of the aisle width. The color field is used by the aggregation.

Update: Changes to the container name will be automatically made in the routings that reference that container.

Remove: Containers cannot be removed if they are currently being referenced in the routing.

Add: Adding a container will display it in the pull-down list on the Routings tab.

Insert Containers at Locations: Add container blocks in the drawing where the parts are delivered to. The following dialog will show up.

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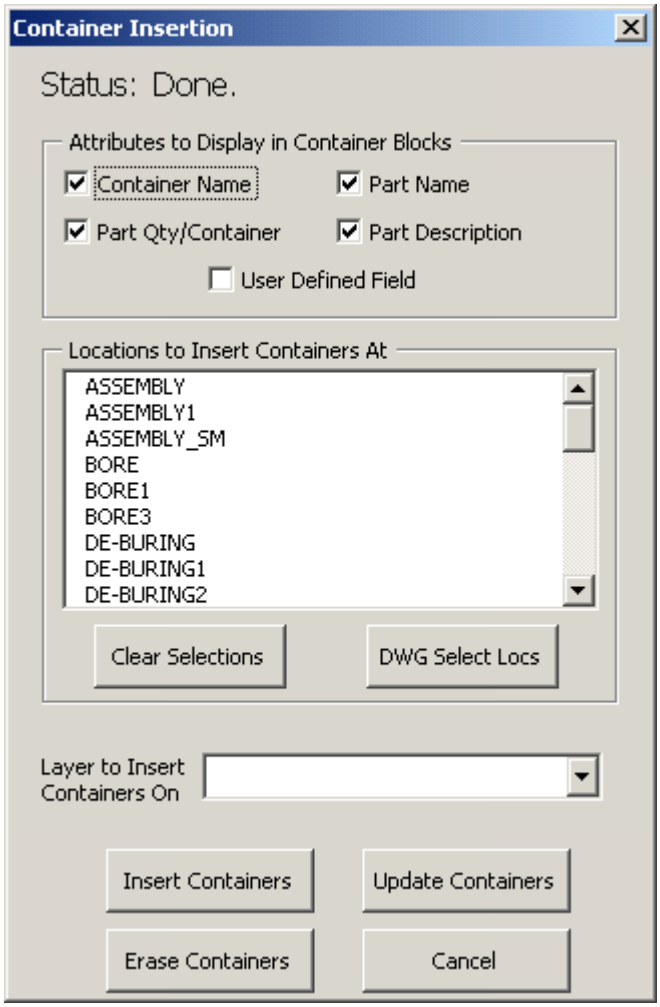

The automatic container insertion feature will automatically create and insert container blocks at Activity locations. This module will read the current routings file and look for all containers delivered to a TO location that matches the selected locations in the dialog box shown above. If a match is found, then this module will look at the number of containers delivered to that TO location per trip. This containers/trip quantity of container blocks will then be inserted at the activity location text insertion point on the layer specified in the dialog box shown above. It is recommended to insert containers on a unique layer so that they are easy to identify and remove if necessary.

If a container block is defined in the drawing (defined by the name of the container) then this application will insert that block. If the block is not defined, then this module will create a container block using the sizes specified for that container in the container tab. NOTE: this module will not re-define a container block should you later change the size of the referenced container. As such, if you need to update the size of a container (using the same name) then you must delete all insertions of that container in your drawing and purge the definition from your drawing before you can re-run this module and expect it to create, define and insert the container using its newly specified size.

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The update containers option is used to re-run this application for a set of activity locations that have already had containers inserted to them. In this case, the program will only insert containers at locations that are missing containers. This is possible, even if the previously inserted containers were moved from the insertion point of the activity location text (where they were originally inserted) because each container block has an attribute that states what activity location it is assigned to.

Attributes to Display in Container Blocks: choose which data to be displayed.

Locations to Insert Containers At: select the locations to display container blocks.

Clear Selections: Clear the selected locations in the list box.

DWG Select Locs: Select the locations in the drawing by specifying an area.

Insert Containers: Insert the container blocks for selected locations

Erase Containers: Erase the container blocks for selected locations

Update Containers: **This function is not enabled**

Cancel: Return to the main window

Import Methods: The methods file contains information about Containers, Methods, Method Types and Processes. Selecting the Import option will reload all three lists in their appropriate tabs.

Save Methods: The methods file contains information about Containers, Methods, Method Types and Processes. Selecting the Save option will save all three lists from their appropriate tabs

Container Group: Allows the user to define groups which containers belong to and to set container specific load/unload times for them on the Process tab.

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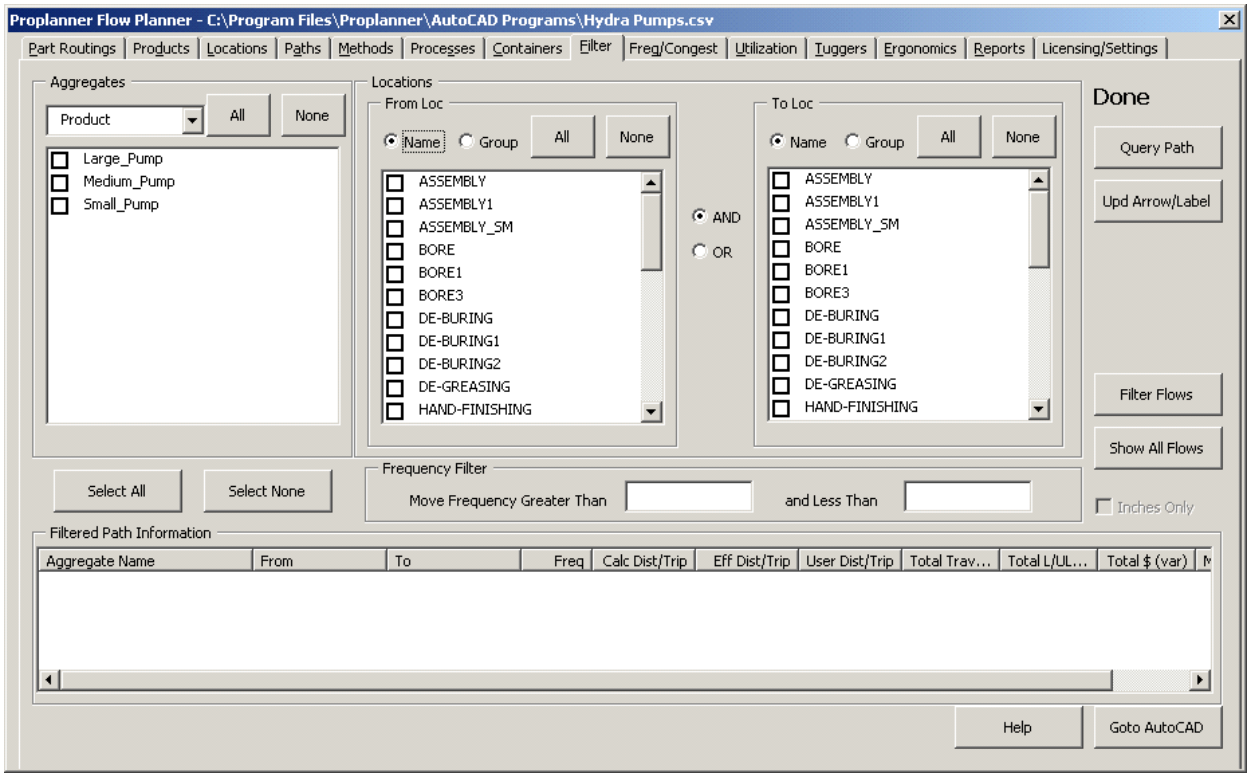
5.10 Filter Tab



The Filter tab allows you to select an aggregation to view and then filter specific flow lines according to aggregate type, From Location or Group and/or To Location or Group. You can also further filter this selection by flow frequency.

Aggregate Pull-down and List: Allows you to select the aggregate method to filter and then select specific aggregate names to view for that method. In the example above, only the Large Pump flows are selected.

The aggregate names shown are generated from the actual flow lines in the drawing. As such, if new flow routes, or aggregates have been added in the current session, they will not show up in the filter aggregates window until after the next Calculation.

From Loc (Name or Group): Allows you to select specific locations (or location groups) to view the flows originating from. In the example shown above, only the flows from the selected locations will be shown.

And/Or: Determines if the flows shown are FROM AND TO or FROM OR TO. If the AND option is selected then only flows specifically from the FROM locations AND to the TO locations will be shown. If the OR option is selected then all flows from the selected FROM locations TO Anywhere, and those flows from Anywhere and to the selected TO locations will be shown. In the example above only flows going from the

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4 selected FROM locations AND to locations in the 2 selected Groups will be shown for the Large Pump.

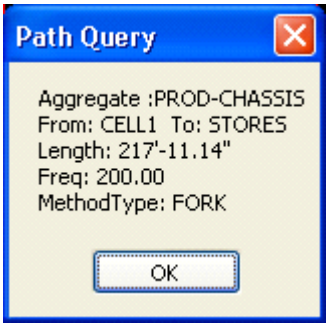
To Loc (Name or Group): Allows you to select specific locations (or location groups) to view the flows with the selected TO destinations.

Frequency Filter: Allows you to select further filter the frequency of flows to view. In the example shown above, only the flows with trip frequencies greater than 250 will be shown.

Filter Flows: Executes the filter function to show only the selected flows.

Show All Flows: Ignores the filter selection and shows all flows for the selected aggregation.

Query Path: Hides the FP Modal window and allows you to select a flow path to query.



Update Arrows/Labels: Regenerates the Arrows and Labels such that only the displayed filtered paths will have arrows.

Filtered Path Information: Displays the path information found on the Paths Tab for only the filtered paths. This information can then be copied and pasted to an Excel file.

Inches Only: Converts feet and inches to inches to avoid possible conversion problems. Make it easier to paste the distance into a spreadsheet and then perform additional calculations on them.

Goto AutoCAD: Hides the FP Modal window and displays a smaller Modeless editing window. You can also execute any AutoCAD command on the menus or command line.

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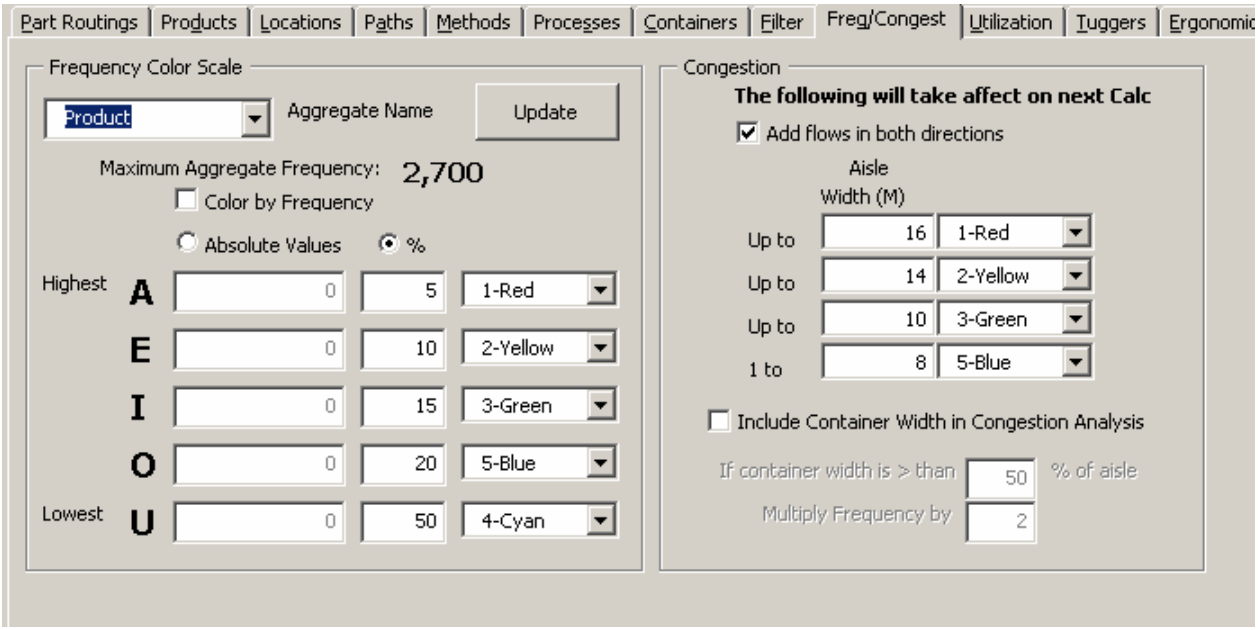
5.11 Frequency/Congestion Tab



The Frequency/Congestion window is used to set the values and colors for the color coding of aggregate flow paths and congestion paths by frequency. By default, the flow paths are color coded by their aggregate name as set in the various Product/Part, Container, Method and Locations/Groups tabs.

This Congestion group of controls is also used to set the aisle width parameters for the congestion analysis when it is desired to take into account the container width in the congestion analysis.

Frequency Color Scale

Aggregate Name: Selects which aggregate flow paths to change the color coding for.

Maximum Aggregate Frequency: shows the largest frequency path found in the selected aggregation.

Color by Frequency: If selected when the Update button is pressed, then the flow lines for the selected aggregation will be color coded by the following frequency parameters. If this is not selected when the update button is pressed then the flow lines will return to their aggregation name colors.

% Values: Allows you to set a percentage of total congestion frequency for the color coding. This means that the program looks at the segment of congestion with the highest flow and says that that is the 100% highest flow and will be red, as will all paths with congestion at 95-100% of that amount of congestion. Paths with half as

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much congestion as that path will have the color assigned to 50%, etc.

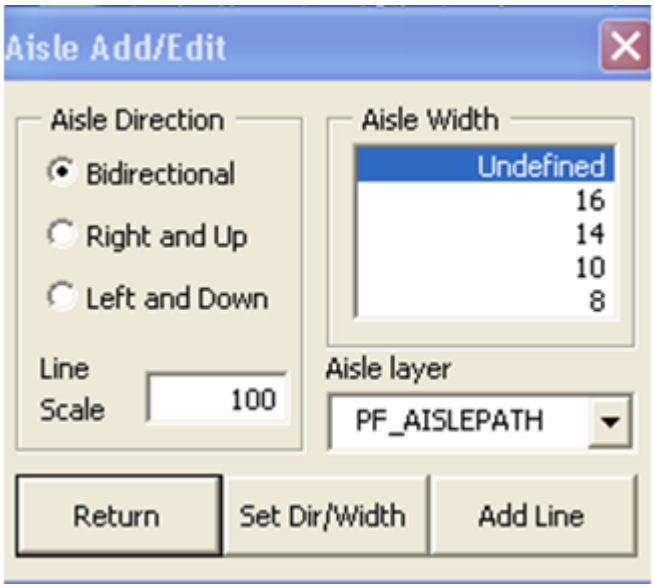
Absolute Values: You can also specify actual frequency values such that anything equal to or greater than the specified value will get the associated color. In the greyed-out boxes you can see that anything greater than (or equal to) 1000 trips would be RED while anything from 700 trips to below 1000 trips would be yellow.

Congestion

Note that no changes will take effect with setting values in this group until after the next Calculate.

Add Flows in Both Directions: If selected then when the Calc button is pressed then there will only be one line between every two aisle nodes in the drawing and this line's thickness will represent the total flow frequency along that segment in both directions. If not selected, then there will be two lines created on that segment (one on top of the other), and each line's width will represent the amount of flow frequency in the line's respective direction.

Aisle Width: Allows you to specify the color of the aisle line in the drawing that would represent an aisle width that you specify. This is then used by the Aisle Add/Edit command (located in the Paths tab) to set the color of the aisle lines in the drawing when they are created. As mentioned in the Path tab documentation, the color of the aisle lines determines their thickness. If the color of an aisle path line is "BYLAYER" then it is given the "Undefined" Aisle thickness and will be ignored for container-width congestion analysis.



Include Container Width in Congestion Analysis: (Not Enabled in Version 1.9) If selected, during the Calc command, then the FP application will evaluate the container width for each route and multiply that route's flow frequency by the

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user-provided factor if the container is equal to, or greater than, the user-specified Container-to-Aisle width percentage.

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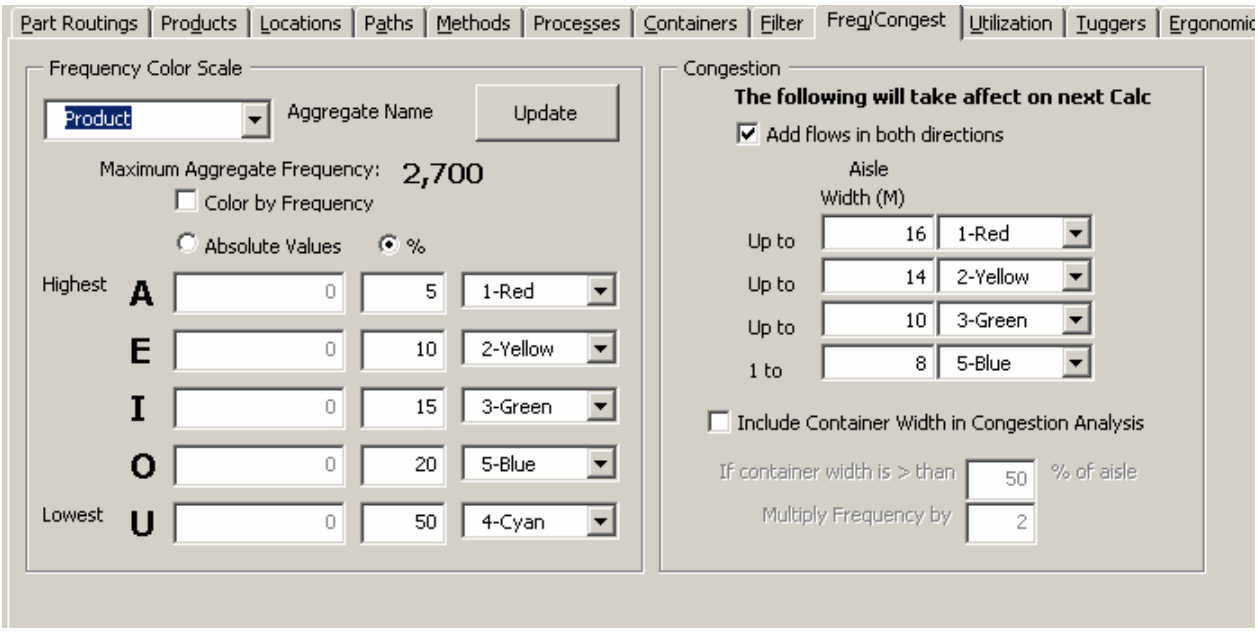
5.11.1 Frequency color scale



The Frequency/Congestion window is used to set the values and colors for the color coding of aggregate flow paths and congestion paths by frequency. By default, the flow paths are color coded by their aggregate name as set in the various Product/Part, Container, Method and Locations/Groups tabs.

This Congestion group of controls is also used to set the aisle width parameters for the congestion analysis when it is desired to take into account the container width in the congestion analysis.

Frequency Color Scale

Aggregate Name: Selects which aggregate flow paths to change the color coding for.

Maximum Aggregate Frequency: shows the largest frequency path found in the selected aggregation.

Color by Frequency: If selected when the Update button is pressed, then the flow lines for the selected aggregation will be color coded by the following frequency parameters. If this is not selected when the update button is pressed then the flow lines will return to their aggregation name colors.

% Values: Allows you to set a percentage of total congestion frequency for the color coding. This means that the program looks at the segment of congestion with the highest flow and says that that is the 100% highest flow and will be red, as will all paths with congestion at 95-100% of that amount of congestion. Paths with half as

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much congestion as that path will have the color assigned to 50%, etc.

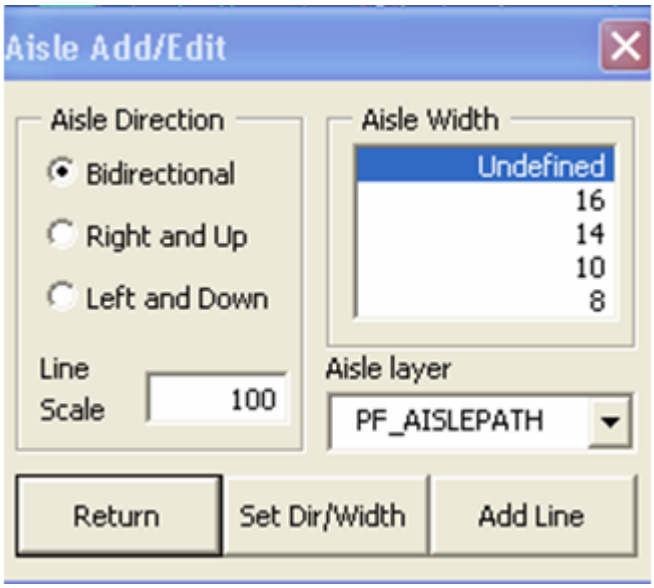
Absolute Values: You can also specify actual frequency values such that anything equal to or greater than the specified value will get the associated color. In the greyed-out boxes you can see that anything greater than (or equal to) 1000 trips would be RED while anything from 700 trips to below 1000 trips would be yellow.

Congestion

Note that no changes will take effect with setting values in this group until after the next Calculate.

Add Flows in Both Directions: If selected then when the Calc button is pressed then there will only be one line between every two aisle nodes in the drawing and this line's thickness will represent the total flow frequency along that segment in both directions. If not selected, then there will be two lines created on that segment (one on top of the other), and each line's width will represent the amount of flow frequency in the line's respective direction.

Aisle Width: Allows you to specify the color of the aisle line in the drawing that would represent an aisle width that you specify. This is then used by the Aisle Add/Edit command (located in the Paths tab) to set the color of the aisle lines in the drawing when they are created. As mentioned in the Path tab documentation, the color of the aisle lines determines their thickness. If the color of an aisle path line is "BYLAYER" then it is given the "Undefined" Aisle thickness and will be ignored for container-width congestion analysis.



Include Container Width in Congestion Analysis: (Not Enabled in Version 1.9) If selected, during the Calc command, then the FP application will evaluate the container width for each route and multiply that route's flow frequency by the

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user-provided factor if the container is equal to, or greater than, the user-specified Container-to-Aisle width percentage.

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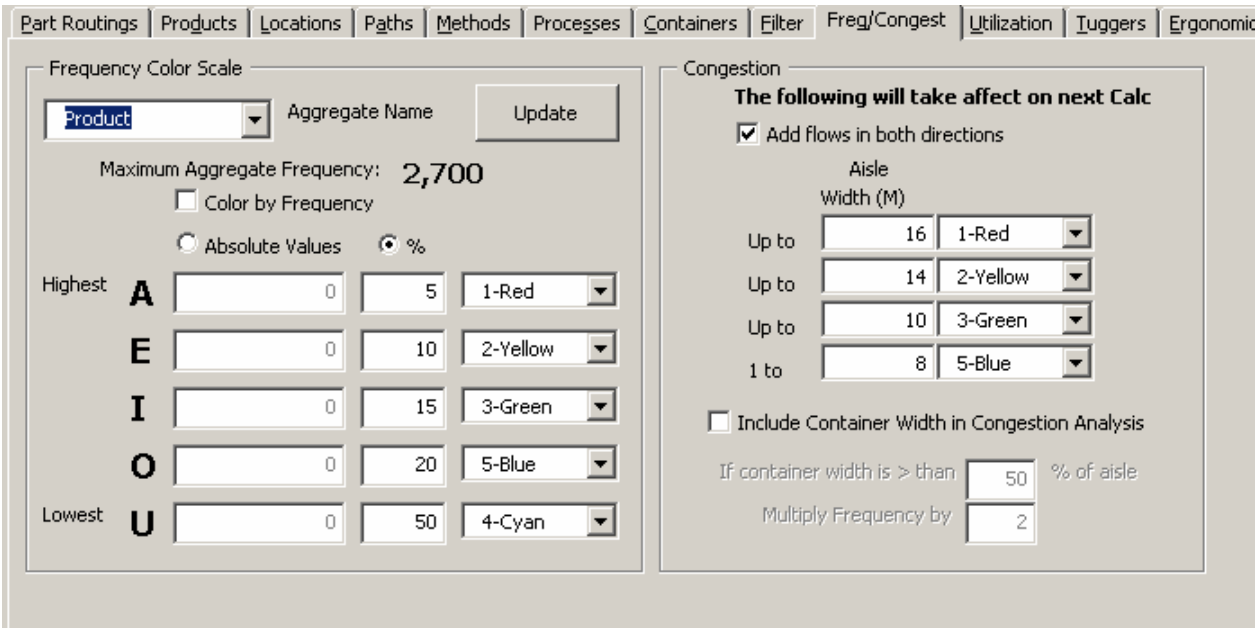
5.11.2 Congestion



The Frequency/Congestion window is used to set the values and colors for the color coding of aggregate flow paths and congestion paths by frequency. By default, the flow paths are color coded by their aggregate name as set in the various Product/Part, Container, Method and Locations/Groups tabs.

This Congestion group of controls is also used to set the aisle width parameters for the congestion analysis when it is desired to take into account the container width in the congestion analysis.

Frequency Color Scale

Aggregate Name: Selects which aggregate flow paths to change the color coding for.

Maximum Aggregate Frequency: shows the largest frequency path found in the selected aggregation.

Color by Frequency: If selected when the Update button is pressed, then the flow lines for the selected aggregation will be color coded by the following frequency parameters. If this is not selected when the update button is pressed then the flow lines will return to their aggregation name colors.

% Values: Allows you to set a percentage of total congestion frequency for the color coding. This means that the program looks at the segment of congestion with the highest flow and says that that is the 100% highest flow and will be red, as will all paths with congestion at 95-100% of that amount of congestion. Paths with half as

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much congestion as that path will have the color assigned to 50%, etc.

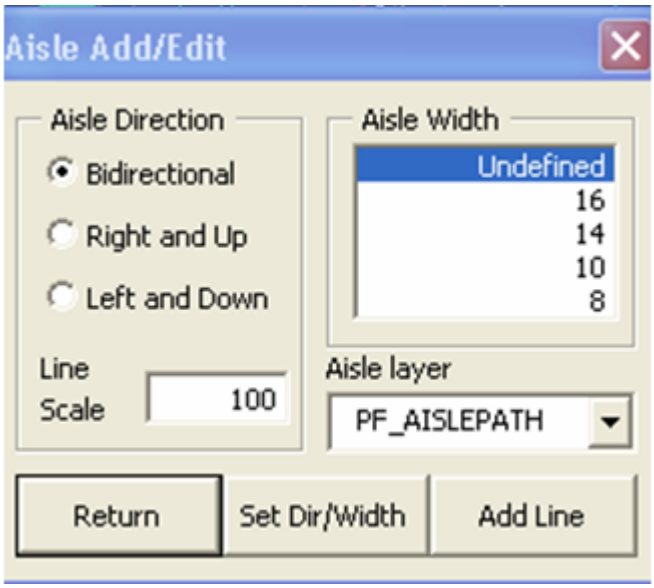
Absolute Values: You can also specify actual frequency values such that anything equal to or greater than the specified value will get the associated color. In the greyed-out boxes you can see that anything greater than (or equal to) 1000 trips would be RED while anything from 700 trips to below 1000 trips would be yellow.

Congestion

Note that no changes will take effect with setting values in this group until after the next Calculate.

Add Flows in Both Directions: If selected then when the Calc button is pressed then there will only be one line between every two aisle nodes in the drawing and this line's thickness will represent the total flow frequency along that segment in both directions. If not selected, then there will be two lines created on that segment (one on top of the other), and each line's width will represent the amount of flow frequency in the line's respective direction.

Aisle Width: Allows you to specify the color of the aisle line in the drawing that would represent an aisle width that you specify. This is then used by the Aisle Add/Edit command (located in the Paths tab) to set the color of the aisle lines in the drawing when they are created. As mentioned in the Path tab documentation, the color of the aisle lines determines their thickness. If the color of an aisle path line is "BYLAYER" then it is given the "Undefined" Aisle thickness and will be ignored for container-width congestion analysis.



Include Container Width in Congestion Analysis: (Not Enabled in Version 1.9) If selected, during the Calc command, then the FP application will evaluate the container width for each route and multiply that route's flow frequency by the

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user-provided factor if the container is equal to, or greater than, the user-specified Container-to-Aisle width percentage.

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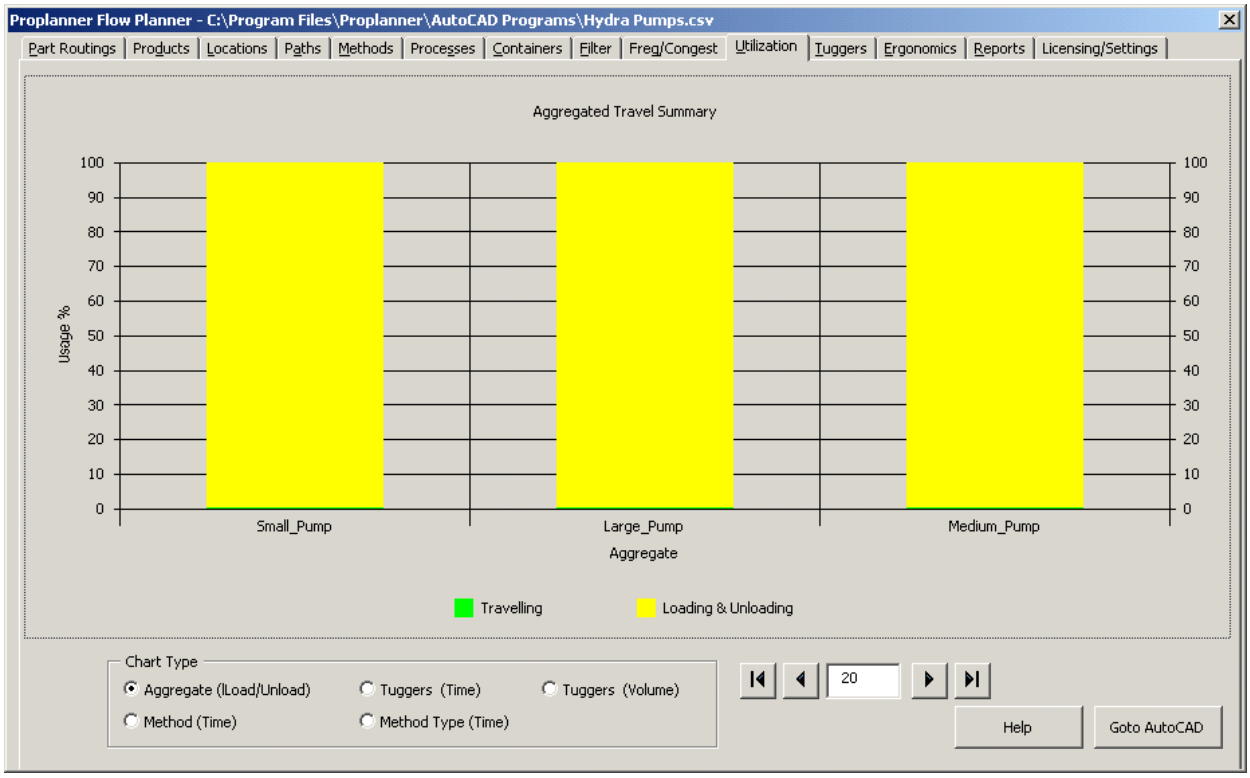
5.12 Utilization Tab



The utilizations chart shows the percentage of travel time versus the percentage of Load/Unload time, busy time, or loaded volume for flows grouped according to the aggregation method. If a tugger analysis was performed, you will be able to view the time utilization of each delivery made by each tugger in its zone. In addition, the Volume option will show the space utilization of the carts being tugged. Similar to the other Flow Planner charts, this chart can be copied and pasted to Excel.

Chart Type

Aggregate (Load/Unload): % of time spent Traveling vs Load/Unloading for the material handling equipment, or aggregate as it is being used. This is a zoom-in of just the Load/Unload and Travel time as shown in Tuggers (Time) or Methods (Time) or Tuggers (Time) charts.

Method (Time): % of time spent Traveling vs Load/Unloading, Idle, and Over Utilized for each Method.

Method Type (Time): % of time spent Traveling vs Load/Unloading, Idle, and Over Utilized for each Method Type.

Tuggers (Time): % of time the tugger is Full, Empty, and Over Utilized

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Tuggers (Volume): % of available volume of the tugger that is Full, Empty, and Over Utilized. Available volume for each delivery route is specified on the Tuggers tab.

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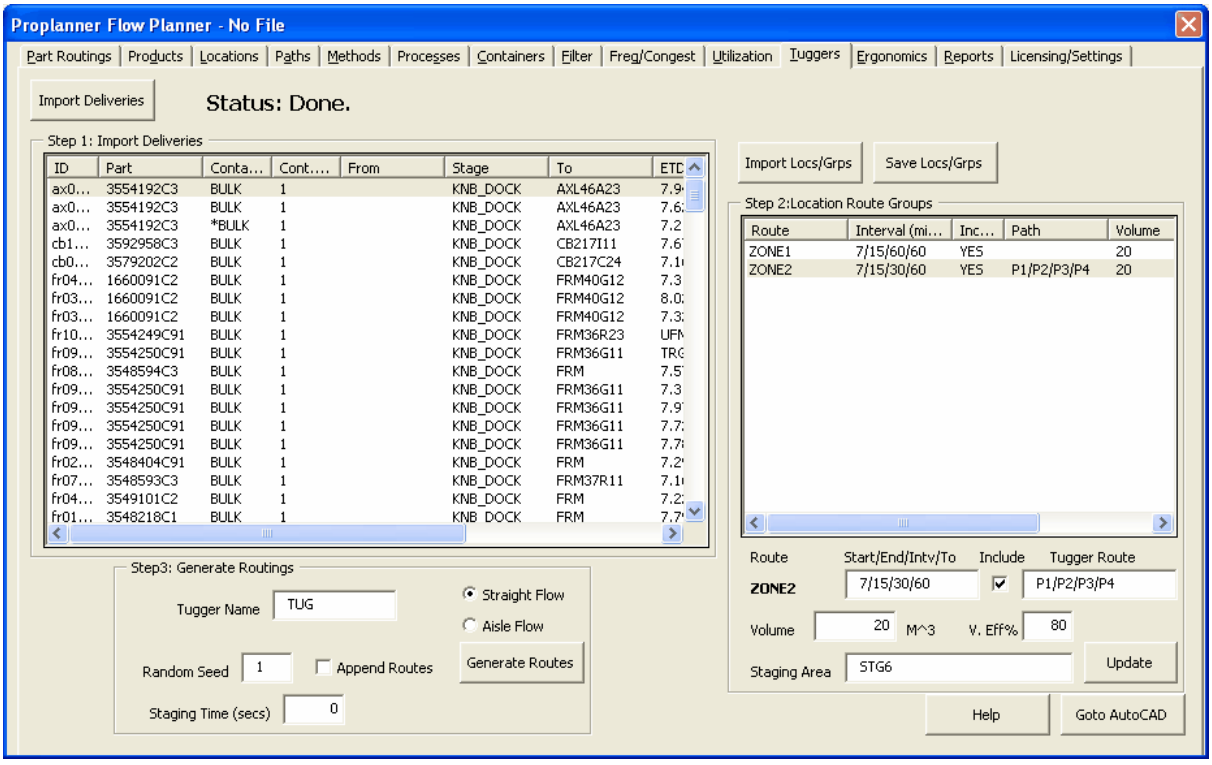
5.13 Tuggers Tab



Note: This tab is functional only with purchase of the Tugger add-on.

The purpose of the Tugger module is to create a set of routings to represent a mixed delivery scenario. This scenario occurs when a material handling device is used to deliver (or pick up) multiple parts to multiple locations along a shortest path route. The order in which the parts are delivered (or picked up) is determined by the tugger module such that the travel path distance (either straight, or aisle-based) is minimized and the tugger travels through each user-defined Passthru point (if any are specified) in the sequence specified in the route definition.

Step 1: Import Deliveries

Clicking the Import Deliveries button prompts the user to select a file containing delivery information for each part. An example of this file can be found in the Help Files folder. The input window where you specify your delivery file name (and also your Methods and Locations file names) is shown below.

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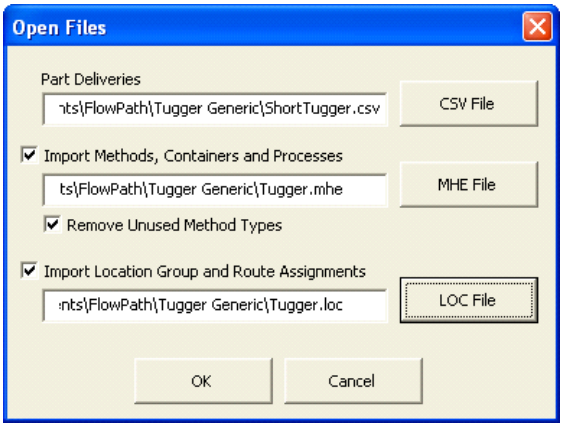

ID: Unique identifier for the delivery of this part to these locations. It is important that there be no duplicates in this field.

Part: Part name that is being moved in this delivery. This will populate the Products tab automatically.

Container: Name of the container being used to transport this part. This is tied to the size information located in the Containers tab. Container sizes are used to determine loaded container volume on the tugger's carts.

Container Qty.: Number of containers that will be delivered, **for each delivery event**, between these locations. Please reference the description on the ETD field to note a special condition with the Uniform or Triangular distribution methods.

From: Location where the part is picked up to be taken to the staging area. This could be an actual pickup location or a drop-off location. While the 'FROM' location is typically specified for loading containers; containers could also be dropped of at these locations (i.e. drop off an empty container and pick up a full one). Use the Direction field to specify if a container is being picked up (dir=1), or dropped off (dir=-1) at this 'FROM' location.

Stage: Location where the carts (trailers) are staged to be delivered to the final destination.

> **Note:** load and unload time is added (combined) at the staging area via the staging time input box at the bottom of this window.

To: Final destination of the parts. This could be an actual delivery location or in-plant drop-off locations. While the 'TO' location is typically specified for deliveries; containers could also be picked up at these locations (i.e. drop off a full container and pick up an empty one). Use the Direction field in this file to specify if a container is being picked up (dir=-1), or dropped off (dir=1) at this 'TO' location.

ETD: Sets up the time that these delivery events need to be made within the given time period. Time is input as a fixed decimal time, a randomly determined decimal time from a Uniform, or Triangular Distribution.

Decimal Time

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This is input as a number 0-23 representing the hour plus a decimal portion of that hour.

7.5 Represents a delivery being made at 7:30AM

Uniform Distribution

This allows the user to set an upper and lower bounds for the deliveries to fall between in a bell curve or uniform distribution pattern with most deliveries taking place around the median time.

UFM(7/15/3/.5) Represents a uniform distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm.

UFM(**7/15**/3/.5) This code means that deliveries are made between 7AM-3PM.

UFM(7/15/**3**/.5) Three deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

UFM(7/15/3/**.5**) They have a 50% probability of being delivered between 7 am and 3pm. Otherwise, this delivery will not result in a container delivery being scheduled in the routings file.

Triangular Distribution

Triangular is similar to the Uniform Distribution with an added third time that sets up the mean time for where the most deliveries occur.

TRG(7/15/10/2/.33) Represents a triangular distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm with a statistical preference for times around 10 am.

TRG(**7/15**/10/2/.33) This code means that deliveries are made between 7AM-3PM.

TRG(7/15/**10**/2/.33) The mean time that these deliveries is made falls at 10AM

TRG(7/15/10/**2**/.33) Two deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

TRG(7/15/10/2/**.33**) They have a 33% probability of being delivered being between 7 am and 3 pm. Otherwise, this delivery will not result in a container delivery being generated in the routings file.

Dir: This is either a **1** if containers are loaded at the 'FROM' location and unloaded at the 'TO' location, or **-1** if they are unloaded at the 'FROM' location and loaded at the 'TO' location. This is used to account for empty returns for example.

1: Staging -> From(load) -> Staging-> To(unload) -> Staging

-1: Staging -> From(unload) -> Staging -> To(load) -> Staging

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Load: The load time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Unload: The unload time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Notice: there are no load or unload times for carts (or containers) that are temporarily stored in the staging area.

Strategies for creating the Deliveries file

There are 4 different formats available to define your deliveries in the Tugger Deliveries File. A delivery file can contain any combination of these formats. Each of the formats discussed below, apply for each delivery time interval for every route. (i.e. for 7am, 8am, 9am, etc. for Route 1 and Route 2 – assuming that deliveries for those routes occur every hour).

1) If a FROM, STAGE and TO location are defined, then the Tugger module will assume that the route delivery RETURN time interval includes the time from STAGING then to all of the FROM locations and then back to STAGING and then out to all of the TO locations, and finally back to STAGING. Essentially, the Tugger route generator is assuming that the material handler who is loading the carts is the same person who delivers all of the containers out in the factory.

2) If a FROM and STAGE location are defined and the TO field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the FROM locations and back to staging. Therefore, there is an implication that a different material handler is unloading these containers out into the factory, in parallel.

3) If a STAGE and TO location are defined and the FROM field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the TO locations and back to staging. Therefore, there is an implication that a different material handler is loading these containers back in the receiving area, in parallel.

4) If a FROM and TO location are defined and the STAGE field is left blank, then the Tugger module will assume that there is no staging area and that containers are being picked up at the FROM location and delivered directly to the TO location. In this situation, the Tugger route generator will sequence the deliveries in order to minimize the total distance for all pickups and deliveries.

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Step 2: Location Route Groups

Import Locs/Grps: Imports a location file that includes the route information for a tugger study.

Save Locs/Grps: Saves the location file with route information appended to it.

Route: This is the name of the route, such as tugger1, route3, etc.

Interval (hours for start and end time and minutes for departure and return intervals): This field defines the daily start and end times (in decimal hours) during which the route is being serviced. In addition, this field defines the time interval (in decimal minutes) when a route driver departs the staging area, and the amount of time that the route driver is allowed to perform the deliveries on that route before he/she must return back to the staging area.

For example:

> **7/15**/30/60 Deliveries are made on this route between 7AM-3PM.
>
> 7/15/**30/60** Deliveries are made in 30 minute intervals and the route driver has 60 minutes to complete the deliveries and return. The fact that a driver is dispatched every 30 minutes and has 60 minutes to complete their work, implies that there are two people delivering on this route, in parallel. The return time must always be equal to or greater than the interval time, and the departure time interval should be a multiple of the return time interval.

Include: This tells the Flow Planner whether or not to include the route in the study. Turning off routes is one way of speeding up the calculations when reports and diagrams for only a subset of the route drivers is desired.

Path: This is where the Passthru point sequence is defined. Passthru points are separated by forward slashes, and must be listed in the same sequence that you wish the route driver to visit those locations. Take special care to ensure that pass-thru points are located directly on an aisle path, or are “Snapped” to an aisle path intersection.

For example:

> A Passthru point sequence of **P1/P2/P3** specifies that this route’s deliveries have to pass through points P1, P2 and P3, in that order (as such, they are called Passthru points). If they do not exist, these Passthru points will be prompted for upon generation of routes. These locations should be uniquely named (different than FROM, TO or STAGE locations, and it is recommended that these names be very short. A Passthru point can appear multiple times in the path field (i.e. **P1/P2/P3/P1/P4**).
>
> Passthru points apply to BOTH the FROM to STAGE route and the STAGE to TO route. Most of the time you will be analyzing EITHER of these and thus you can simply specify the passthru points as shown above. If you are doing

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a study involving flows FROM to STAGE AND STAGE to TO, and you only want the Passthru points to apply EITHER to the FROM to STAGE or the STAGE to TO delivery, then you must prefix your Passthru point sequence with either ***F** or ***T** indicating if the list applies to the FROM portion or the TO portion of the delivery respectively. The following example, shows a Passthru point sequence that applies only to the STAGE to TO portion of the delivery ***T/P1/P2/P3.**

Volume: Represents the volume capacity (specified in cubic Meters or cubic Feet) of the tugger's carts (trailers) operating along that Route. So if you want to do tugger cart capacity using **QUANTITY of containers as opposed to VOLUME of containers**, then you will need to specify the size of each container as 12x12x12 inches (or 1000x1000x1000 millimeters) depending upon your base drawing units, so that each container is exactly one cubic foot, or meter.

The Flow Planner will first compute the quantity of containers required for storage on the carts for each route delivery. These quantities will be multiplied by the volume for each of the containers in order to compute the total requested delivery volume. You may reference the Utilizations and Reports tabs to view the comparison of the requested container volume to that of the available volume.

IMPORTANT NOTE: If the FROM to STAGING to TO format is used (described above), the program computes the Total volume of containers for the entire route, and thus will double count the required cart volume. In this case double the amount of available volume on this delivery route. A future enhancement to the software will fix this potential issue.

Eff%: This number is the packing efficiency of the tugger's carts (trailers) operating along that route. For example, a tugger with a total volume capacity of 10 cubic meters and with a packing efficiency of 80% (given the general size and shape of the containers put on the carts) would have an actual volume capacity of 8 cubic meters.

Staging Area: Normally, the staging location for a delivery is specified in the deliveries file - STAGE field. This forces the delivered part to always use that staging area, regardless of what zone driver delivers the part. Often, you may wish to have the staging area mapped to the zone driver and not to the delivered part. In this case, you simply specify the name of the Staging area for that zone driver and this will override the name of the staging area specified in that part's delivery route. It is important to note, that you still must specify a Staging location name for the delivery route in the deliveries file, even if you intend to override this name with the zone driver's staging area. In this situation, simply specify a default name (i.e. like STAGE) in the delivery file, so that the application will know that you want to route that part through a staging area.

Update: Updates any changes made to a selected route's properties.

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Step 3: Generate Routings

Tugger Name: Name of the **Method Type** that will represent the tugger routes. The **Method** name will be the Route name. As such, each tugger Route will have its own unique method.

Straight Flow: Creates routings where the shortest path between locations is determined based on Euclidean (Straight point-to-point) flows.

Aisle Flow: Creates routings where the shortest path between locations is determined based on Aisle-Based flows.

Random Seed: This value sets the start point for creating the random sample used to create the Uniform or Triangular distributions.

Append Routes: If selected, the Tugger routings will be attached to any existing flow path routings on the Routings tab instead of overwriting them.

Generate Routes: Creates the tugger routes in the Routings window for each tugger route at each departure time in which there are containers to deliver.

Staging Time: Defines the amount of time (in seconds) that all tuggers will be delayed at the staging location. In the example screen shown above, the time has been set to 60 seconds. Note this time is added once per cycle (trip out and back) and not for both the trip out and back.

Unused Deliveries

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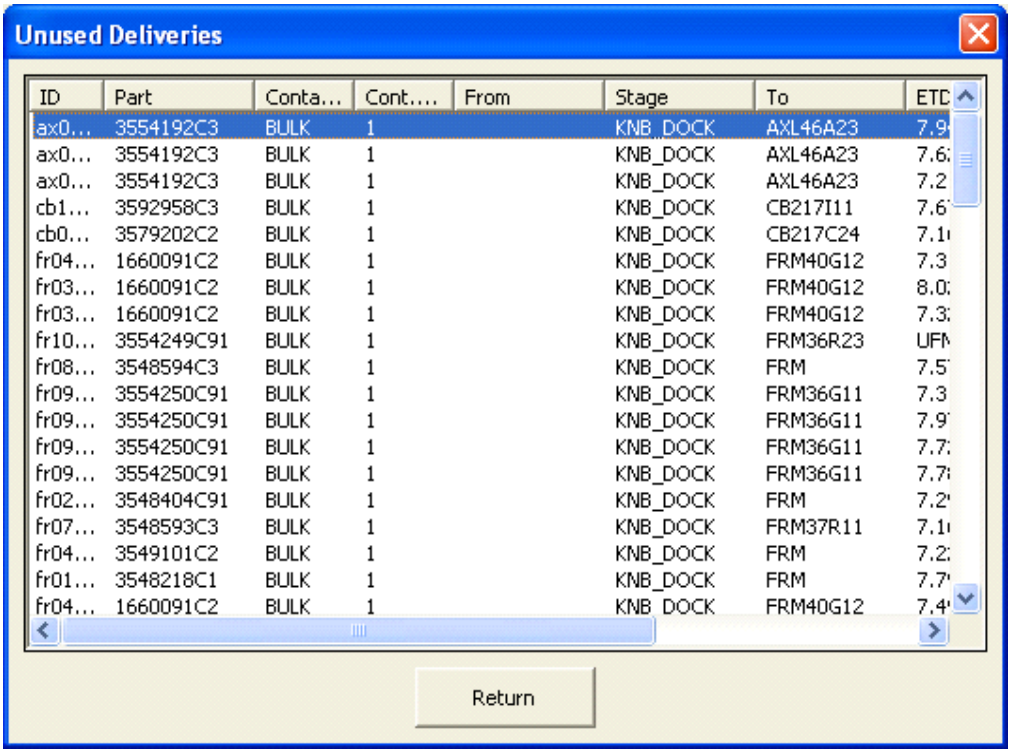

If one or more delivery lines (from the deliveries file) does not generate one, or more, corresponding routing lines, then these original delivery lines will be shown in the unused deliveries list. As with all list boxes in the Flow Planner, you may copy and paste this list into MS Excel.

This can happen if:

1) The delivery's ETD is not within its corresponding route driver service interval (i.e. start and end time)
2) The FROM and/or TO location (if specified) is not assigned to a route
3) If the delivery time was specified with a random probability of occurrence and it did not get selected by the random number generator.

Tugger Created Routing Notes

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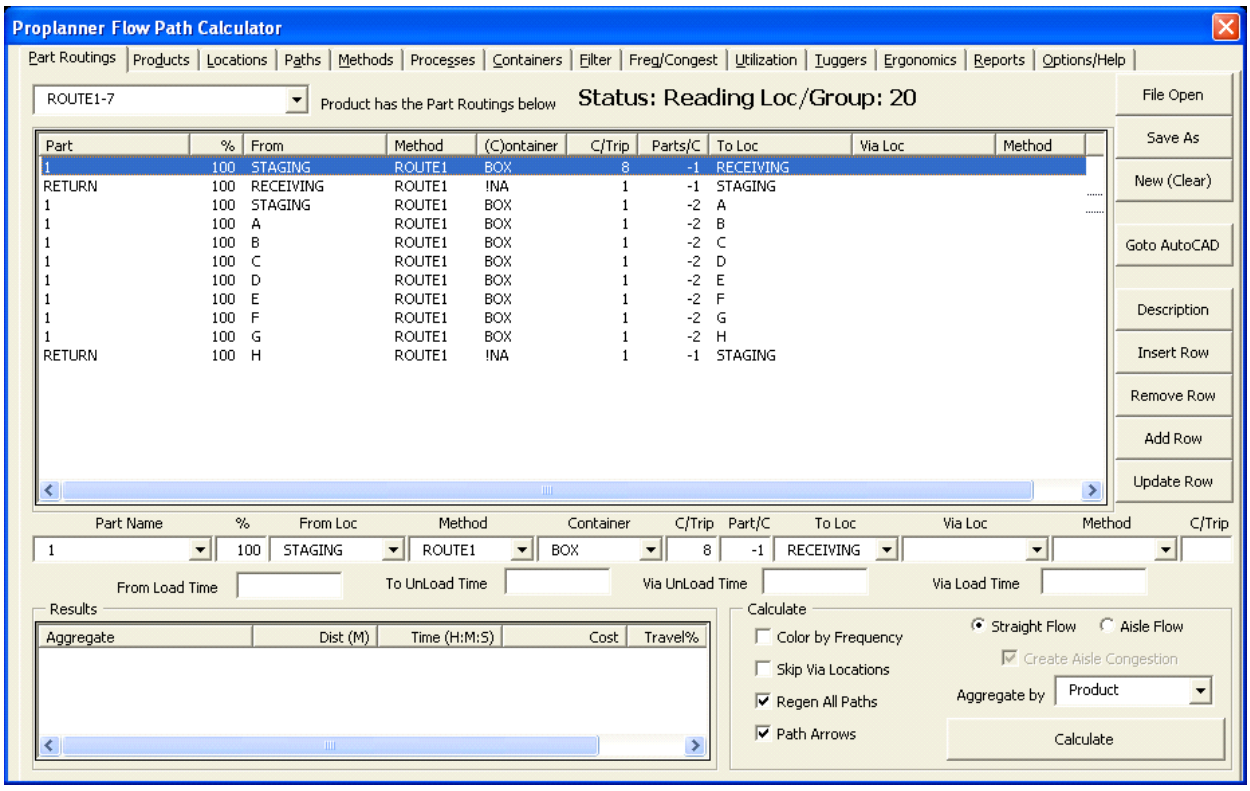

The routings generated by the Tuggers tab for the Routings tab look very different than the standard setup for the Flow Planner. We will use the simple example above to discuss the differences.

- This route makes eight deliveries of one part to eight different locations (A-H). The part name Return represents a return trip to the staging area where no load or unload time is calculated, thus the “!NA” container name. This tells the program to calculate the distance and walk time and ignore the load/unload time.
- The Tugger Module creates products that represent the tugger route name and start time (ie. Route1-7 means these are the routings for Route1 at 7AM).
- The routings themselves are broken down into their individual segments to show every load or unload at each location for the appropriate number of containers.
- Because the material handling device starts at staging and goes to the From location first, the volume is calculated for on the first routing from Staging to Receiving because it is Loading 8 containers at Receiving.
- The Parts per container are -1 to if a load is performed at the TO location and -2 when an unload is performed. This is only a signal for the program, not a value actually used for calculation.

Given this information, the example above shows the empty material handling device

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starting at Staging. It then goes to Receiving where it Loads 8 containers and returns to Staging. The next step takes it to location A-H in the shortest paths to make sure deliveries are made at the times designated on the Tuggers tab. Finally, the material handling device returns to staging where again no load/unload time is calculated because it is assumed empty at this time.

Note: The deliveries in this example were made in this order due to having sequential ETDs on the Tuggers tab. Had these been set up using Uniform or Triangular Distributions with a random seed, there is no guarantee the routes would have been scheduled at this time of day or in this order.

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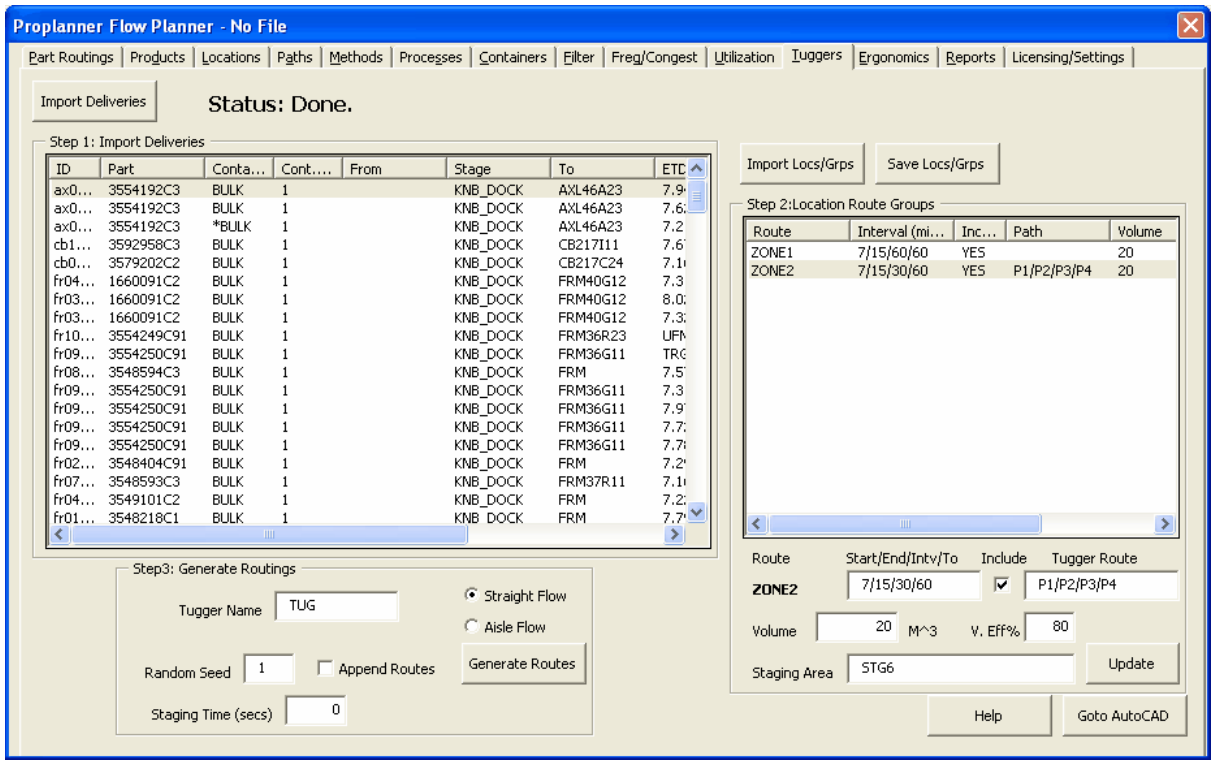
5.13.1 Step 1: Import Deliveries



Note: This tab is functional only with purchase of the Tugger add-on.

The purpose of the Tugger module is to create a set of routings to represent a mixed delivery scenario. This scenario occurs when a material handling device is used to deliver (or pick up) multiple parts to multiple locations along a shortest path route. The order in which the parts are delivered (or picked up) is determined by the tugger module such that the travel path distance (either straight, or aisle-based) is minimized and the tugger travels through each user-defined Passthru point (if any are specified) in the sequence specified in the route definition.

Step 1: Import Deliveries

Clicking the Import Deliveries button prompts the user to select a file containing delivery information for each part. An example of this file can be found in the Help Files folder. The input window where you specify your delivery file name (and also your Methods and Locations file names) is shown below.

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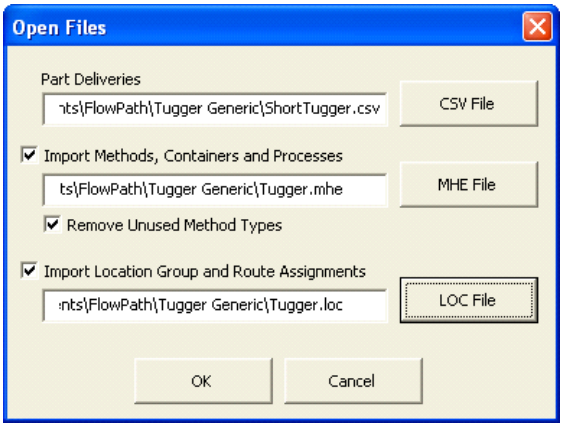

ID: Unique identifier for the delivery of this part to these locations. It is important that there be no duplicates in this field.

Part: Part name that is being moved in this delivery. This will populate the Products tab automatically.

Container: Name of the container being used to transport this part. This is tied to the size information located in the Containers tab. Container sizes are used to determine loaded container volume on the tugger's carts.

Container Qty.: Number of containers that will be delivered, **for each delivery event**, between these locations. Please reference the description on the ETD field to note a special condition with the Uniform or Triangular distribution methods.

From: Location where the part is picked up to be taken to the staging area. This could be an actual pickup location or a drop-off location. While the 'FROM' location is typically specified for loading containers; containers could also be dropped of at these locations (i.e. drop off an empty container and pick up a full one). Use the Direction field to specify if a container is being picked up (dir=1), or dropped off (dir=-1) at this 'FROM' location.

Stage: Location where the carts (trailers) are staged to be delivered to the final destination.

> **Note:** load and unload time is added (combined) at the staging area via the staging time input box at the bottom of this window.

To: Final destination of the parts. This could be an actual delivery location or in-plant drop-off locations. While the 'TO' location is typically specified for deliveries; containers could also be picked up at these locations (i.e. drop off a full container and pick up an empty one). Use the Direction field in this file to specify if a container is being picked up (dir=-1), or dropped off (dir=1) at this 'TO' location.

ETD: Sets up the time that these delivery events need to be made within the given time period. Time is input as a fixed decimal time, a randomly determined decimal time from a Uniform, or Triangular Distribution.

Decimal Time

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This is input as a number 0-23 representing the hour plus a decimal portion of that hour.

7.5 Represents a delivery being made at 7:30AM

Uniform Distribution

This allows the user to set an upper and lower bounds for the deliveries to fall between in a bell curve or uniform distribution pattern with most deliveries taking place around the median time.

UFM(7/15/3/.5) Represents a uniform distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm.

UFM(**7/15**/3/.5) This code means that deliveries are made between 7AM-3PM.

UFM(7/15/**3**/.5) Three deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

UFM(7/15/3/**.5**) They have a 50% probability of being delivered between 7 am and 3pm. Otherwise, this delivery will not result in a container delivery being scheduled in the routings file.

Triangular Distribution

Triangular is similar to the Uniform Distribution with an added third time that sets up the mean time for where the most deliveries occur.

TRG(7/15/10/2/.33) Represents a triangular distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm with a statistical preference for times around 10 am.

TRG(**7/15**/10/2/.33) This code means that deliveries are made between 7AM-3PM.

TRG(7/15/**10**/2/.33) The mean time that these deliveries is made falls at 10AM

TRG(7/15/10/**2**/.33) Two deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

TRG(7/15/10/2/**.33**) They have a 33% probability of being delivered being between 7 am and 3 pm. Otherwise, this delivery will not result in a container delivery being generated in the routings file.

Dir: This is either a **1** if containers are loaded at the 'FROM' location and unloaded at the 'TO' location, or **-1** if they are unloaded at the 'FROM' location and loaded at the 'TO' location. This is used to account for empty returns for example.

1: Staging -> From(load) -> Staging-> To(unload) -> Staging

-1: Staging -> From(unload) -> Staging -> To(load) -> Staging

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Load: The load time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Unload: The unload time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Notice: there are no load or unload times for carts (or containers) that are temporarily stored in the staging area.

Strategies for creating the Deliveries file

There are 4 different formats available to define your deliveries in the Tugger Deliveries File. A delivery file can contain any combination of these formats. Each of the formats discussed below, apply for each delivery time interval for every route. (i.e. for 7am, 8am, 9am, etc. for Route 1 and Route 2 – assuming that deliveries for those routes occur every hour).

1) If a FROM, STAGE and TO location are defined, then the Tugger module will assume that the route delivery RETURN time interval includes the time from STAGING then to all of the FROM locations and then back to STAGING and then out to all of the TO locations, and finally back to STAGING. Essentially, the Tugger route generator is assuming that the material handler who is loading the carts is the same person who delivers all of the containers out in the factory.

2) If a FROM and STAGE location are defined and the TO field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the FROM locations and back to staging. Therefore, there is an implication that a different material handler is unloading these containers out into the factory, in parallel.

3) If a STAGE and TO location are defined and the FROM field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the TO locations and back to staging. Therefore, there is an implication that a different material handler is loading these containers back in the receiving area, in parallel.

4) If a FROM and TO location are defined and the STAGE field is left blank, then the Tugger module will assume that there is no staging area and that containers are being picked up at the FROM location and delivered directly to the TO location. In this situation, the Tugger route generator will sequence the deliveries in order to minimize the total distance for all pickups and deliveries.

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Step 2: Location Route Groups

Import Locs/Grps: Imports a location file that includes the route information for a tugger study.

Save Locs/Grps: Saves the location file with route information appended to it.

Route: This is the name of the route, such as tugger1, route3, etc.

Interval (hours for start and end time and minutes for departure and return intervals): This field defines the daily start and end times (in decimal hours) during which the route is being serviced. In addition, this field defines the time interval (in decimal minutes) when a route driver departs the staging area, and the amount of time that the route driver is allowed to perform the deliveries on that route before he/she must return back to the staging area.

For example:

> **7/15**/30/60 Deliveries are made on this route between 7AM-3PM.
>
> 7/15/**30/60** Deliveries are made in 30 minute intervals and the route driver has 60 minutes to complete the deliveries and return. The fact that a driver is dispatched every 30 minutes and has 60 minutes to complete their work, implies that there are two people delivering on this route, in parallel. The return time must always be equal to or greater than the interval time, and the departure time interval should be a multiple of the return time interval.

Include: This tells the Flow Planner whether or not to include the route in the study. Turning off routes is one way of speeding up the calculations when reports and diagrams for only a subset of the route drivers is desired.

Path: This is where the Passthru point sequence is defined. Passthru points are separated by forward slashes, and must be listed in the same sequence that you wish the route driver to visit those locations. Take special care to ensure that pass-thru points are located directly on an aisle path, or are “Snapped” to an aisle path intersection.

For example:

> A Passthru point sequence of **P1/P2/P3** specifies that this route’s deliveries have to pass through points P1, P2 and P3, in that order (as such, they are called Passthru points). If they do not exist, these Passthru points will be prompted for upon generation of routes. These locations should be uniquely named (different than FROM, TO or STAGE locations, and it is recommended that these names be very short. A Passthru point can appear multiple times in the path field (i.e. **P1/P2/P3/P1/P4**).
>
> Passthru points apply to BOTH the FROM to STAGE route and the STAGE to TO route. Most of the time you will be analyzing EITHER of these and thus you can simply specify the passthru points as shown above. If you are doing

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a study involving flows FROM to STAGE AND STAGE to TO, and you only want the Passthru points to apply EITHER to the FROM to STAGE or the STAGE to TO delivery, then you must prefix your Passthru point sequence with either ***F** or ***T** indicating if the list applies to the FROM portion or the TO portion of the delivery respectively. The following example, shows a Passthru point sequence that applies only to the STAGE to TO portion of the delivery ***T/P1/P2/P3.**

Volume: Represents the volume capacity (specified in cubic Meters or cubic Feet) of the tugger's carts (trailers) operating along that Route. So if you want to do tugger cart capacity using **QUANTITY of containers as opposed to VOLUME of containers**, then you will need to specify the size of each container as 12x12x12 inches (or 1000x1000x1000 millimeters) depending upon your base drawing units, so that each container is exactly one cubic foot, or meter.

The Flow Planner will first compute the quantity of containers required for storage on the carts for each route delivery. These quantities will be multiplied by the volume for each of the containers in order to compute the total requested delivery volume. You may reference the Utilizations and Reports tabs to view the comparison of the requested container volume to that of the available volume.

IMPORTANT NOTE: If the FROM to STAGING to TO format is used (described above), the program computes the Total volume of containers for the entire route, and thus will double count the required cart volume. In this case double the amount of available volume on this delivery route. A future enhancement to the software will fix this potential issue.

Eff%: This number is the packing efficiency of the tugger's carts (trailers) operating along that route. For example, a tugger with a total volume capacity of 10 cubic meters and with a packing efficiency of 80% (given the general size and shape of the containers put on the carts) would have an actual volume capacity of 8 cubic meters.

Staging Area: Normally, the staging location for a delivery is specified in the deliveries file - STAGE field. This forces the delivered part to always use that staging area, regardless of what zone driver delivers the part. Often, you may wish to have the staging area mapped to the zone driver and not to the delivered part. In this case, you simply specify the name of the Staging area for that zone driver and this will override the name of the staging area specified in that part's delivery route. It is important to note, that you still must specify a Staging location name for the delivery route in the deliveries file, even if you intend to override this name with the zone driver's staging area. In this situation, simply specify a default name (i.e. like STAGE) in the delivery file, so that the application will know that you want to route that part through a staging area.

Update: Updates any changes made to a selected route's properties.

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Step 3: Generate Routings

Tugger Name: Name of the **Method Type** that will represent the tugger routes. The **Method** name will be the Route name. As such, each tugger Route will have its own unique method.

Straight Flow: Creates routings where the shortest path between locations is determined based on Euclidean (Straight point-to-point) flows.

Aisle Flow: Creates routings where the shortest path between locations is determined based on Aisle-Based flows.

Random Seed: This value sets the start point for creating the random sample used to create the Uniform or Triangular distributions.

Append Routes: If selected, the Tugger routings will be attached to any existing flow path routings on the Routings tab instead of overwriting them.

Generate Routes: Creates the tugger routes in the Routings window for each tugger route at each departure time in which there are containers to deliver.

Staging Time: Defines the amount of time (in seconds) that all tuggers will be delayed at the staging location. In the example screen shown above, the time has been set to 60 seconds. Note this time is added once per cycle (trip out and back) and not for both the trip out and back.

Unused Deliveries

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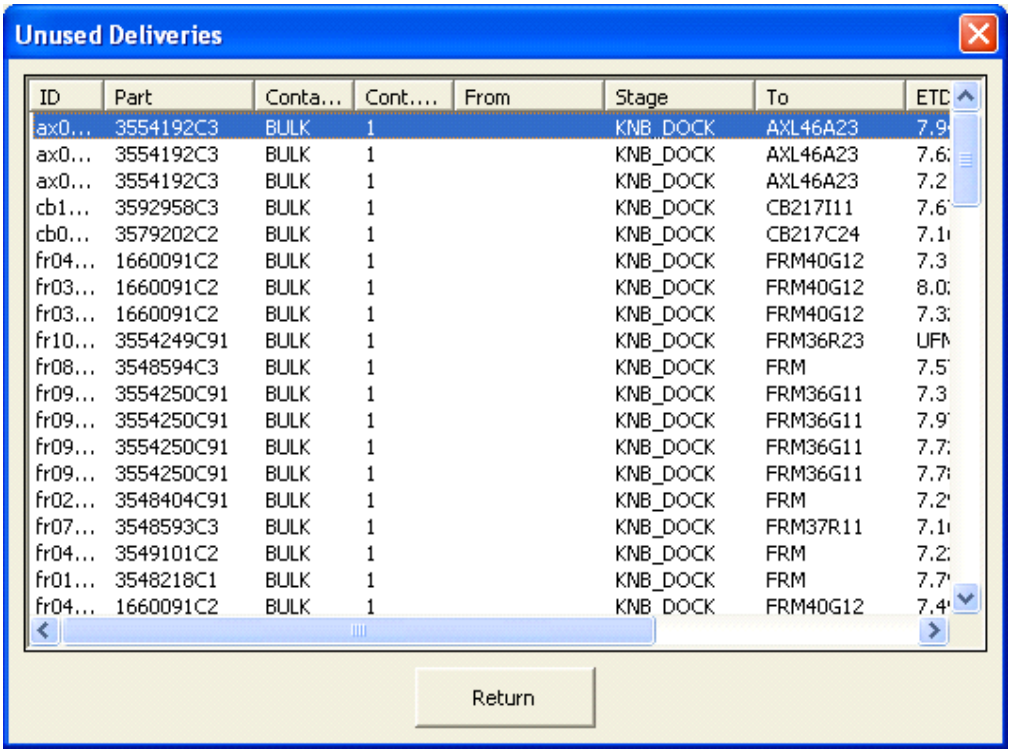

If one or more delivery lines (from the deliveries file) does not generate one, or more, corresponding routing lines, then these original delivery lines will be shown in the unused deliveries list. As with all list boxes in the Flow Planner, you may copy and paste this list into MS Excel.

This can happen if:

1) The delivery's ETD is not within its corresponding route driver service interval (i.e. start and end time)
2) The FROM and/or TO location (if specified) is not assigned to a route
3) If the delivery time was specified with a random probability of occurrence and it did not get selected by the random number generator.

Tugger Created Routing Notes

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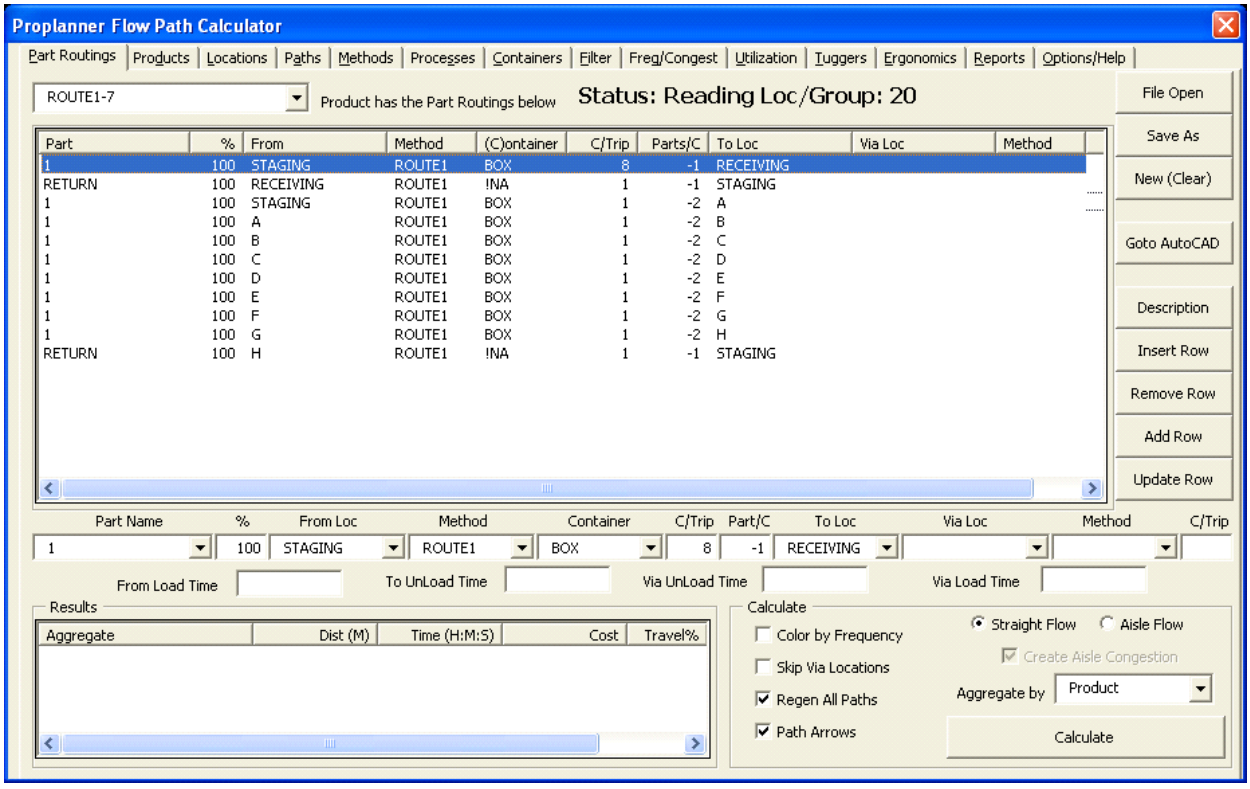

The routings generated by the Tuggers tab for the Routings tab look very different than the standard setup for the Flow Planner. We will use the simple example above to discuss the differences.

- This route makes eight deliveries of one part to eight different locations (A-H). The part name Return represents a return trip to the staging area where no load or unload time is calculated, thus the “!NA” container name. This tells the program to calculate the distance and walk time and ignore the load/unload time.
- The Tugger Module creates products that represent the tugger route name and start time (ie. Route1-7 means these are the routings for Route1 at 7AM).
- The routings themselves are broken down into their individual segments to show every load or unload at each location for the appropriate number of containers.
- Because the material handling device starts at staging and goes to the From location first, the volume is calculated for on the first routing from Staging to Receiving because it is Loading 8 containers at Receiving.
- The Parts per container are -1 to if a load is performed at the TO location and -2 when an unload is performed. This is only a signal for the program, not a value actually used for calculation.

Given this information, the example above shows the empty material handling device

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starting at Staging. It then goes to Receiving where it Loads 8 containers and returns to Staging. The next step takes it to location A-H in the shortest paths to make sure deliveries are made at the times designated on the Tuggers tab. Finally, the material handling device returns to staging where again no load/unload time is calculated because it is assumed empty at this time.

Note: The deliveries in this example were made in this order due to having sequential ETDs on the Tuggers tab. Had these been set up using Uniform or Triangular Distributions with a random seed, there is no guarantee the routes would have been scheduled at this time of day or in this order.

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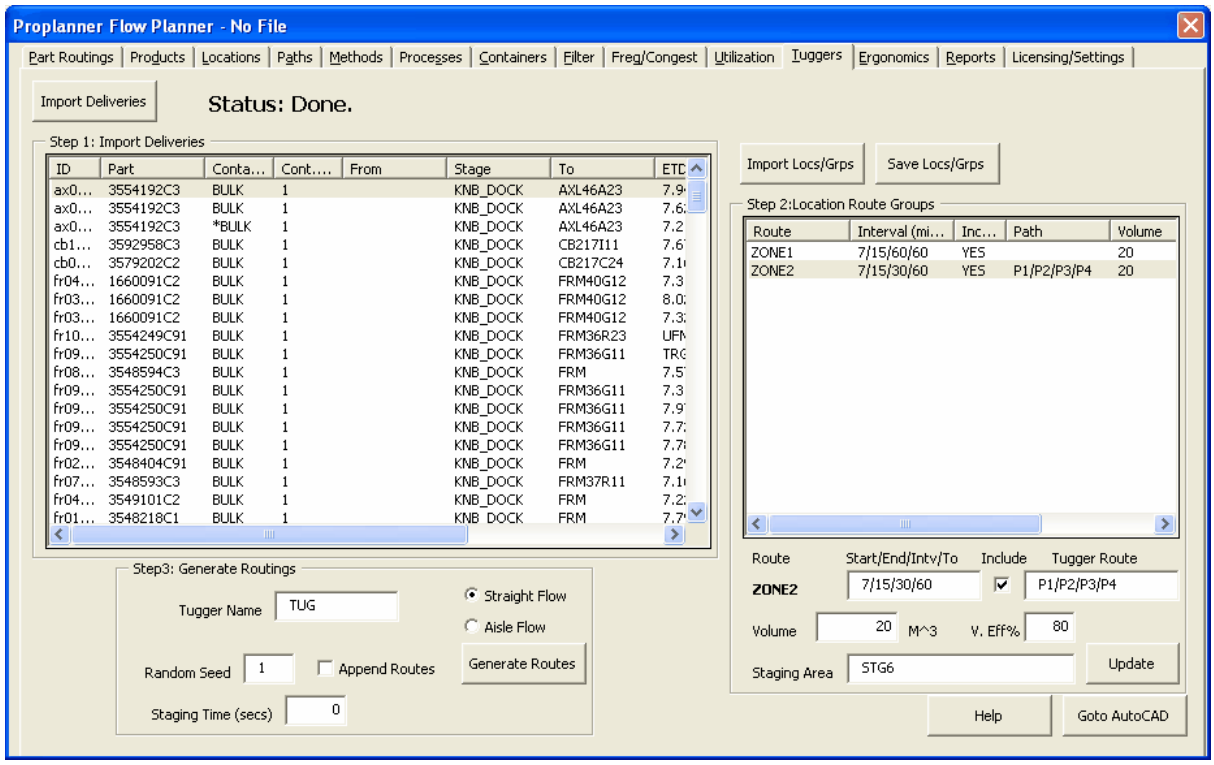
5.13.2 Step 2: Location Route Groups



Note: This tab is functional only with purchase of the Tugger add-on.

The purpose of the Tugger module is to create a set of routings to represent a mixed delivery scenario. This scenario occurs when a material handling device is used to deliver (or pick up) multiple parts to multiple locations along a shortest path route. The order in which the parts are delivered (or picked up) is determined by the tugger module such that the travel path distance (either straight, or aisle-based) is minimized and the tugger travels through each user-defined Passthru point (if any are specified) in the sequence specified in the route definition.

Step 1: Import Deliveries

Clicking the Import Deliveries button prompts the user to select a file containing delivery information for each part. An example of this file can be found in the Help Files folder. The input window where you specify your delivery file name (and also your Methods and Locations file names) is shown below.

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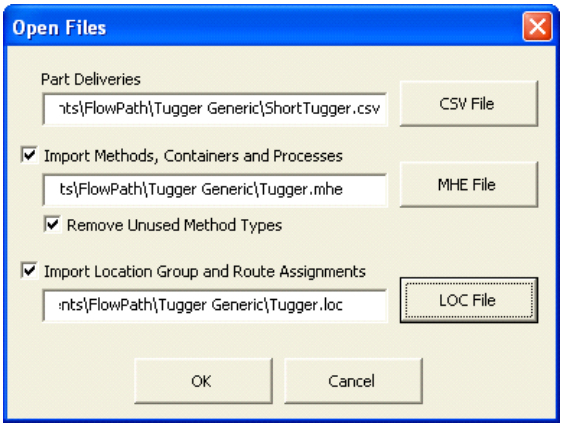

ID: Unique identifier for the delivery of this part to these locations. It is important that there be no duplicates in this field.

Part: Part name that is being moved in this delivery. This will populate the Products tab automatically.

Container: Name of the container being used to transport this part. This is tied to the size information located in the Containers tab. Container sizes are used to determine loaded container volume on the tugger's carts.

Container Qty.: Number of containers that will be delivered, **for each delivery event**, between these locations. Please reference the description on the ETD field to note a special condition with the Uniform or Triangular distribution methods.

From: Location where the part is picked up to be taken to the staging area. This could be an actual pickup location or a drop-off location. While the 'FROM' location is typically specified for loading containers; containers could also be dropped of at these locations (i.e. drop off an empty container and pick up a full one). Use the Direction field to specify if a container is being picked up (dir=1), or dropped off (dir=-1) at this 'FROM' location.

Stage: Location where the carts (trailers) are staged to be delivered to the final destination.

> **Note:** load and unload time is added (combined) at the staging area via the staging time input box at the bottom of this window.

To: Final destination of the parts. This could be an actual delivery location or in-plant drop-off locations. While the 'TO' location is typically specified for deliveries; containers could also be picked up at these locations (i.e. drop off a full container and pick up an empty one). Use the Direction field in this file to specify if a container is being picked up (dir=-1), or dropped off (dir=1) at this 'TO' location.

ETD: Sets up the time that these delivery events need to be made within the given time period. Time is input as a fixed decimal time, a randomly determined decimal time from a Uniform, or Triangular Distribution.

Decimal Time

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This is input as a number 0-23 representing the hour plus a decimal portion of that hour.

7.5 Represents a delivery being made at 7:30AM

Uniform Distribution

This allows the user to set an upper and lower bounds for the deliveries to fall between in a bell curve or uniform distribution pattern with most deliveries taking place around the median time.

UFM(7/15/3/.5) Represents a uniform distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm.

UFM(**7/15**/3/.5) This code means that deliveries are made between 7AM-3PM.

UFM(7/15/**3**/.5) Three deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

UFM(7/15/3/**.5**) They have a 50% probability of being delivered between 7 am and 3pm. Otherwise, this delivery will not result in a container delivery being scheduled in the routings file.

Triangular Distribution

Triangular is similar to the Uniform Distribution with an added third time that sets up the mean time for where the most deliveries occur.

TRG(7/15/10/2/.33) Represents a triangular distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm with a statistical preference for times around 10 am.

TRG(**7/15**/10/2/.33) This code means that deliveries are made between 7AM-3PM.

TRG(7/15/**10**/2/.33) The mean time that these deliveries is made falls at 10AM

TRG(7/15/10/**2**/.33) Two deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

TRG(7/15/10/2/**.33**) They have a 33% probability of being delivered being between 7 am and 3 pm. Otherwise, this delivery will not result in a container delivery being generated in the routings file.

Dir: This is either a **1** if containers are loaded at the 'FROM' location and unloaded at the 'TO' location, or **-1** if they are unloaded at the 'FROM' location and loaded at the 'TO' location. This is used to account for empty returns for example.

1: Staging -> From(load) -> Staging-> To(unload) -> Staging

-1: Staging -> From(unload) -> Staging -> To(load) -> Staging

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Load: The load time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Unload: The unload time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Notice: there are no load or unload times for carts (or containers) that are temporarily stored in the staging area.

Strategies for creating the Deliveries file

There are 4 different formats available to define your deliveries in the Tugger Deliveries File. A delivery file can contain any combination of these formats. Each of the formats discussed below, apply for each delivery time interval for every route. (i.e. for 7am, 8am, 9am, etc. for Route 1 and Route 2 – assuming that deliveries for those routes occur every hour).

1) If a FROM, STAGE and TO location are defined, then the Tugger module will assume that the route delivery RETURN time interval includes the time from STAGING then to all of the FROM locations and then back to STAGING and then out to all of the TO locations, and finally back to STAGING. Essentially, the Tugger route generator is assuming that the material handler who is loading the carts is the same person who delivers all of the containers out in the factory.

2) If a FROM and STAGE location are defined and the TO field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the FROM locations and back to staging. Therefore, there is an implication that a different material handler is unloading these containers out into the factory, in parallel.

3) If a STAGE and TO location are defined and the FROM field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the TO locations and back to staging. Therefore, there is an implication that a different material handler is loading these containers back in the receiving area, in parallel.

4) If a FROM and TO location are defined and the STAGE field is left blank, then the Tugger module will assume that there is no staging area and that containers are being picked up at the FROM location and delivered directly to the TO location. In this situation, the Tugger route generator will sequence the deliveries in order to minimize the total distance for all pickups and deliveries.

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Step 2: Location Route Groups

Import Locs/Grps: Imports a location file that includes the route information for a tugger study.

Save Locs/Grps: Saves the location file with route information appended to it.

Route: This is the name of the route, such as tugger1, route3, etc.

Interval (hours for start and end time and minutes for departure and return intervals): This field defines the daily start and end times (in decimal hours) during which the route is being serviced. In addition, this field defines the time interval (in decimal minutes) when a route driver departs the staging area, and the amount of time that the route driver is allowed to perform the deliveries on that route before he/she must return back to the staging area.

For example:

> **7/15**/30/60 Deliveries are made on this route between 7AM-3PM.
>
> 7/15/**30/60** Deliveries are made in 30 minute intervals and the route driver has 60 minutes to complete the deliveries and return. The fact that a driver is dispatched every 30 minutes and has 60 minutes to complete their work, implies that there are two people delivering on this route, in parallel. The return time must always be equal to or greater than the interval time, and the departure time interval should be a multiple of the return time interval.

Include: This tells the Flow Planner whether or not to include the route in the study. Turning off routes is one way of speeding up the calculations when reports and diagrams for only a subset of the route drivers is desired.

Path: This is where the Passthru point sequence is defined. Passthru points are separated by forward slashes, and must be listed in the same sequence that you wish the route driver to visit those locations. Take special care to ensure that pass-thru points are located directly on an aisle path, or are “Snapped” to an aisle path intersection.

For example:

> A Passthru point sequence of **P1/P2/P3** specifies that this route’s deliveries have to pass through points P1, P2 and P3, in that order (as such, they are called Passthru points). If they do not exist, these Passthru points will be prompted for upon generation of routes. These locations should be uniquely named (different than FROM, TO or STAGE locations, and it is recommended that these names be very short. A Passthru point can appear multiple times in the path field (i.e. **P1/P2/P3/P1/P4**).
>
> Passthru points apply to BOTH the FROM to STAGE route and the STAGE to TO route. Most of the time you will be analyzing EITHER of these and thus you can simply specify the passthru points as shown above. If you are doing

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a study involving flows FROM to STAGE AND STAGE to TO, and you only want the Passthru points to apply EITHER to the FROM to STAGE or the STAGE to TO delivery, then you must prefix your Passthru point sequence with either ***F** or ***T** indicating if the list applies to the FROM portion or the TO portion of the delivery respectively. The following example, shows a Passthru point sequence that applies only to the STAGE to TO portion of the delivery ***T/P1/P2/P3.**

Volume: Represents the volume capacity (specified in cubic Meters or cubic Feet) of the tugger's carts (trailers) operating along that Route. So if you want to do tugger cart capacity using **QUANTITY of containers as opposed to VOLUME of containers**, then you will need to specify the size of each container as 12x12x12 inches (or 1000x1000x1000 millimeters) depending upon your base drawing units, so that each container is exactly one cubic foot, or meter.

The Flow Planner will first compute the quantity of containers required for storage on the carts for each route delivery. These quantities will be multiplied by the volume for each of the containers in order to compute the total requested delivery volume. You may reference the Utilizations and Reports tabs to view the comparison of the requested container volume to that of the available volume.

IMPORTANT NOTE: If the FROM to STAGING to TO format is used (described above), the program computes the Total volume of containers for the entire route, and thus will double count the required cart volume. In this case double the amount of available volume on this delivery route. A future enhancement to the software will fix this potential issue.

Eff%: This number is the packing efficiency of the tugger's carts (trailers) operating along that route. For example, a tugger with a total volume capacity of 10 cubic meters and with a packing efficiency of 80% (given the general size and shape of the containers put on the carts) would have an actual volume capacity of 8 cubic meters.

Staging Area: Normally, the staging location for a delivery is specified in the deliveries file - STAGE field. This forces the delivered part to always use that staging area, regardless of what zone driver delivers the part. Often, you may wish to have the staging area mapped to the zone driver and not to the delivered part. In this case, you simply specify the name of the Staging area for that zone driver and this will override the name of the staging area specified in that part's delivery route. It is important to note, that you still must specify a Staging location name for the delivery route in the deliveries file, even if you intend to override this name with the zone driver's staging area. In this situation, simply specify a default name (i.e. like STAGE) in the delivery file, so that the application will know that you want to route that part through a staging area.

Update: Updates any changes made to a selected route's properties.

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Step 3: Generate Routings

Tugger Name: Name of the **Method Type** that will represent the tugger routes. The **Method** name will be the Route name. As such, each tugger Route will have its own unique method.

Straight Flow: Creates routings where the shortest path between locations is determined based on Euclidean (Straight point-to-point) flows.

Aisle Flow: Creates routings where the shortest path between locations is determined based on Aisle-Based flows.

Random Seed: This value sets the start point for creating the random sample used to create the Uniform or Triangular distributions.

Append Routes: If selected, the Tugger routings will be attached to any existing flow path routings on the Routings tab instead of overwriting them.

Generate Routes: Creates the tugger routes in the Routings window for each tugger route at each departure time in which there are containers to deliver.

Staging Time: Defines the amount of time (in seconds) that all tuggers will be delayed at the staging location. In the example screen shown above, the time has been set to 60 seconds. Note this time is added once per cycle (trip out and back) and not for both the trip out and back.

Unused Deliveries

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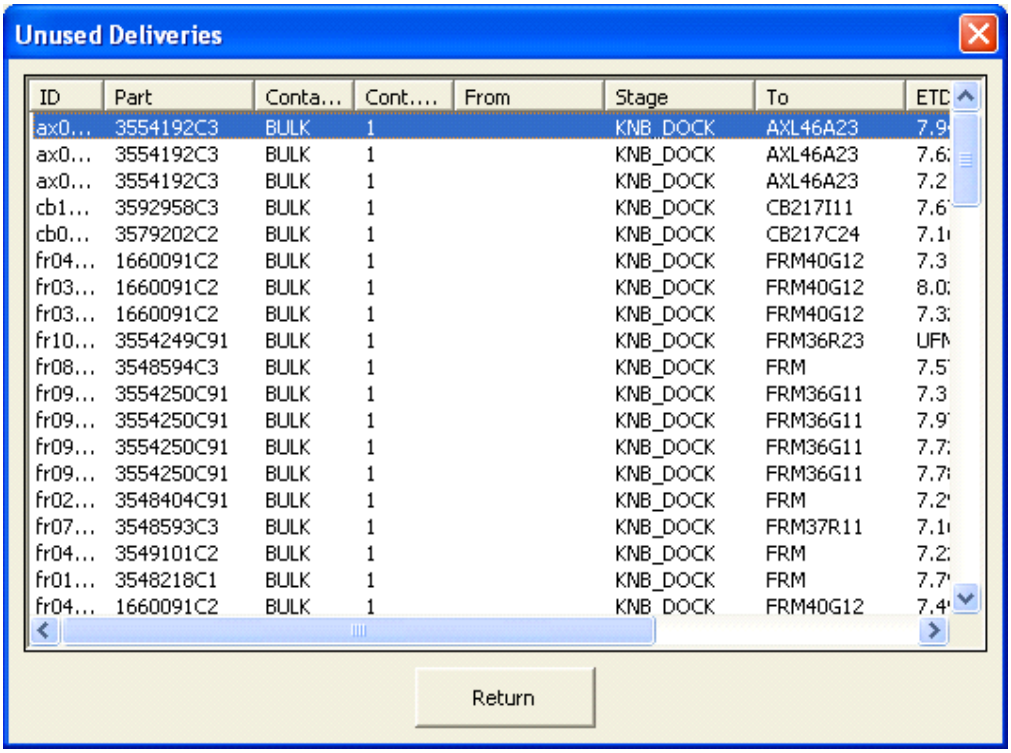

If one or more delivery lines (from the deliveries file) does not generate one, or more, corresponding routing lines, then these original delivery lines will be shown in the unused deliveries list. As with all list boxes in the Flow Planner, you may copy and paste this list into MS Excel.

This can happen if:

1) The delivery's ETD is not within its corresponding route driver service interval (i.e. start and end time)
2) The FROM and/or TO location (if specified) is not assigned to a route
3) If the delivery time was specified with a random probability of occurrence and it did not get selected by the random number generator.

Tugger Created Routing Notes

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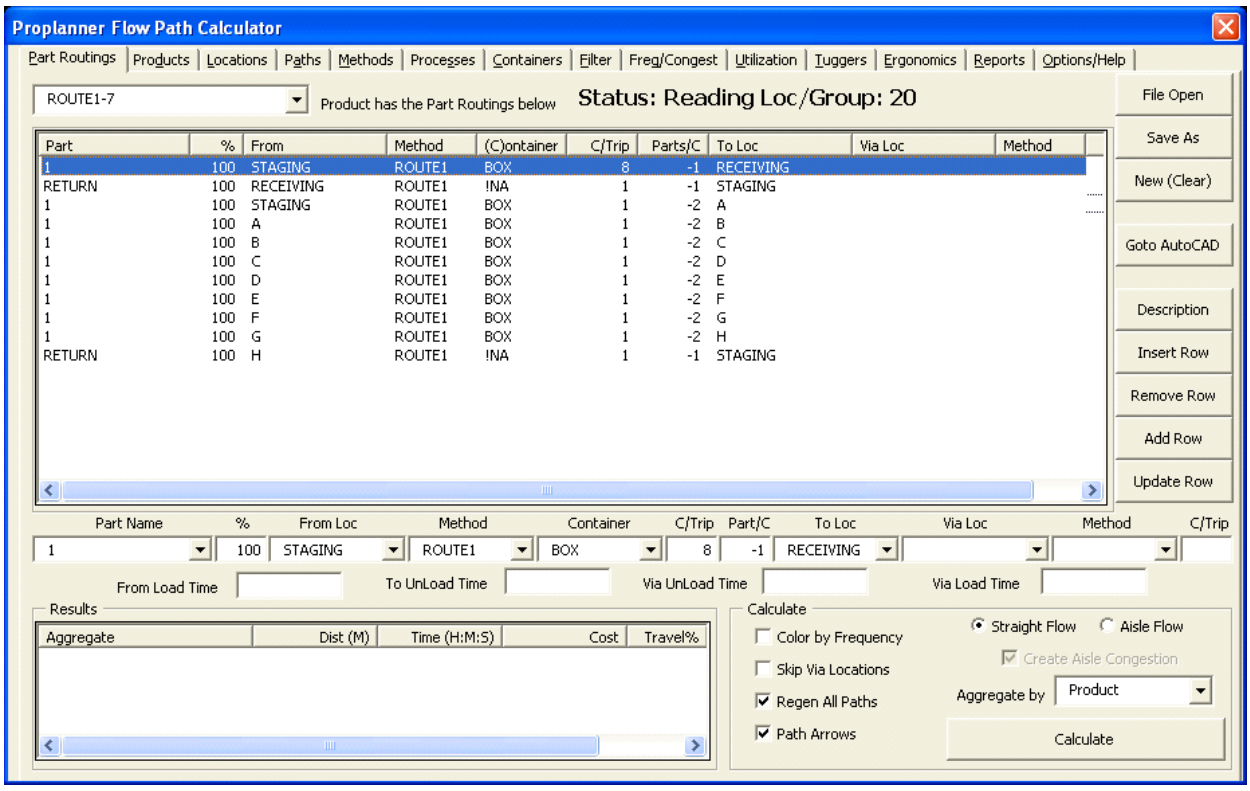

The routings generated by the Tuggers tab for the Routings tab look very different than the standard setup for the Flow Planner. We will use the simple example above to discuss the differences.

- This route makes eight deliveries of one part to eight different locations (A-H). The part name Return represents a return trip to the staging area where no load or unload time is calculated, thus the “!NA” container name. This tells the program to calculate the distance and walk time and ignore the load/unload time.
- The Tugger Module creates products that represent the tugger route name and start time (ie. Route1-7 means these are the routings for Route1 at 7AM).
- The routings themselves are broken down into their individual segments to show every load or unload at each location for the appropriate number of containers.
- Because the material handling device starts at staging and goes to the From location first, the volume is calculated for on the first routing from Staging to Receiving because it is Loading 8 containers at Receiving.
- The Parts per container are -1 to if a load is performed at the TO location and -2 when an unload is performed. This is only a signal for the program, not a value actually used for calculation.

Given this information, the example above shows the empty material handling device

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starting at Staging. It then goes to Receiving where it Loads 8 containers and returns to Staging. The next step takes it to location A-H in the shortest paths to make sure deliveries are made at the times designated on the Tuggers tab. Finally, the material handling device returns to staging where again no load/unload time is calculated because it is assumed empty at this time.

Note: The deliveries in this example were made in this order due to having sequential ETDs on the Tuggers tab. Had these been set up using Uniform or Triangular Distributions with a random seed, there is no guarantee the routes would have been scheduled at this time of day or in this order.

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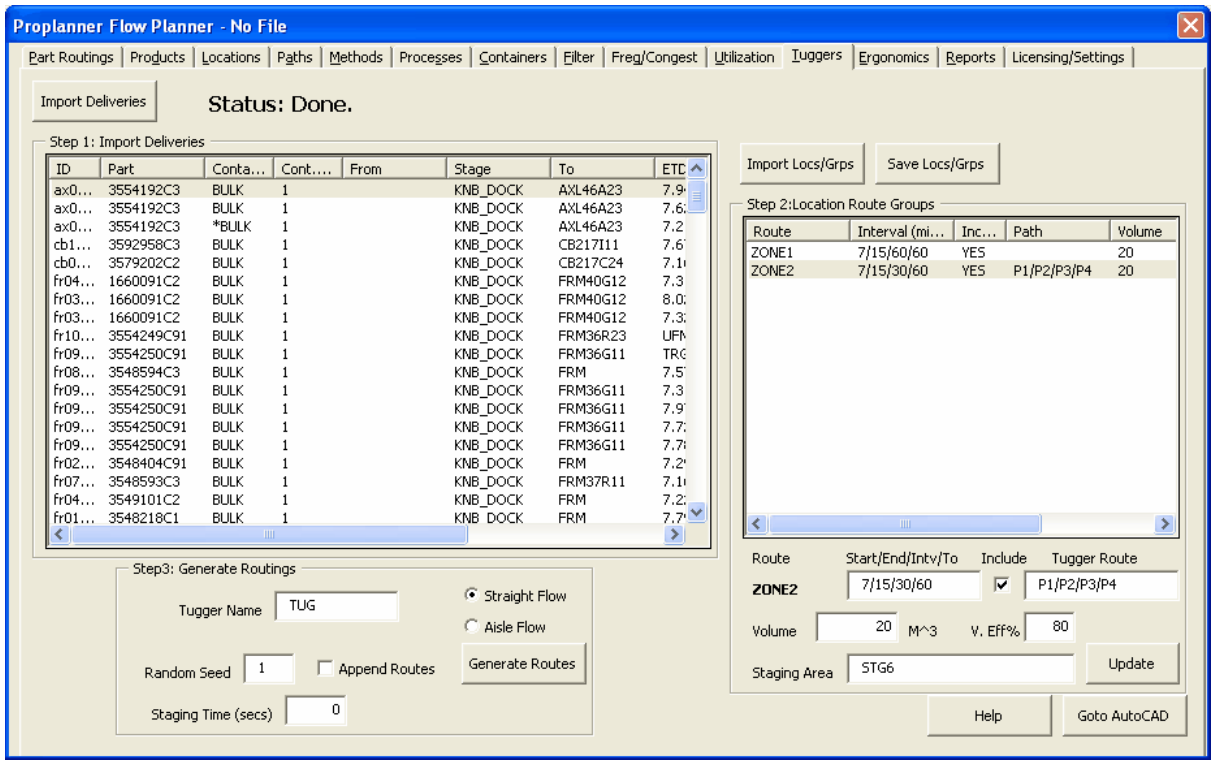
5.13.3 Step 3: Generate Routings



Note: This tab is functional only with purchase of the Tugger add-on.

The purpose of the Tugger module is to create a set of routings to represent a mixed delivery scenario. This scenario occurs when a material handling device is used to deliver (or pick up) multiple parts to multiple locations along a shortest path route. The order in which the parts are delivered (or picked up) is determined by the tugger module such that the travel path distance (either straight, or aisle-based) is minimized and the tugger travels through each user-defined Passthru point (if any are specified) in the sequence specified in the route definition.

Step 1: Import Deliveries

Clicking the Import Deliveries button prompts the user to select a file containing delivery information for each part. An example of this file can be found in the Help Files folder. The input window where you specify your delivery file name (and also your Methods and Locations file names) is shown below.

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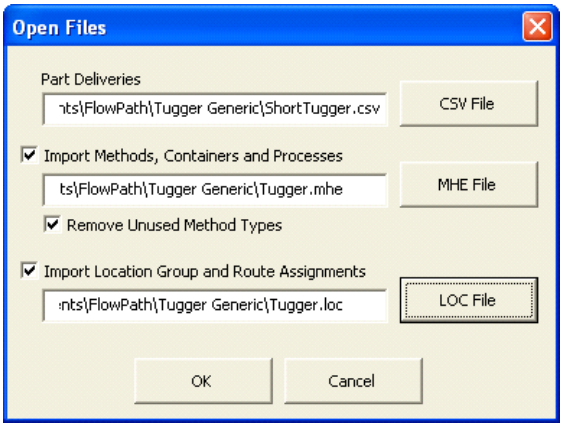

ID: Unique identifier for the delivery of this part to these locations. It is important that there be no duplicates in this field.

Part: Part name that is being moved in this delivery. This will populate the Products tab automatically.

Container: Name of the container being used to transport this part. This is tied to the size information located in the Containers tab. Container sizes are used to determine loaded container volume on the tugger's carts.

Container Qty.: Number of containers that will be delivered, **for each delivery event**, between these locations. Please reference the description on the ETD field to note a special condition with the Uniform or Triangular distribution methods.

From: Location where the part is picked up to be taken to the staging area. This could be an actual pickup location or a drop-off location. While the 'FROM' location is typically specified for loading containers; containers could also be dropped of at these locations (i.e. drop off an empty container and pick up a full one). Use the Direction field to specify if a container is being picked up (dir=1), or dropped off (dir=-1) at this 'FROM' location.

Stage: Location where the carts (trailers) are staged to be delivered to the final destination.

> **Note:** load and unload time is added (combined) at the staging area via the staging time input box at the bottom of this window.

To: Final destination of the parts. This could be an actual delivery location or in-plant drop-off locations. While the 'TO' location is typically specified for deliveries; containers could also be picked up at these locations (i.e. drop off a full container and pick up an empty one). Use the Direction field in this file to specify if a container is being picked up (dir=-1), or dropped off (dir=1) at this 'TO' location.

ETD: Sets up the time that these delivery events need to be made within the given time period. Time is input as a fixed decimal time, a randomly determined decimal time from a Uniform, or Triangular Distribution.

Decimal Time

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This is input as a number 0-23 representing the hour plus a decimal portion of that hour.

7.5 Represents a delivery being made at 7:30AM

Uniform Distribution

This allows the user to set an upper and lower bounds for the deliveries to fall between in a bell curve or uniform distribution pattern with most deliveries taking place around the median time.

UFM(7/15/3/.5) Represents a uniform distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm.

UFM(**7/15**/3/.5) This code means that deliveries are made between 7AM-3PM.

UFM(7/15/**3**/.5) Three deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

UFM(7/15/3/**.5**) They have a 50% probability of being delivered between 7 am and 3pm. Otherwise, this delivery will not result in a container delivery being scheduled in the routings file.

Triangular Distribution

Triangular is similar to the Uniform Distribution with an added third time that sets up the mean time for where the most deliveries occur.

TRG(7/15/10/2/.33) Represents a triangular distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm with a statistical preference for times around 10 am.

TRG(**7/15**/10/2/.33) This code means that deliveries are made between 7AM-3PM.

TRG(7/15/**10**/2/.33) The mean time that these deliveries is made falls at 10AM

TRG(7/15/10/**2**/.33) Two deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

TRG(7/15/10/2/**.33**) They have a 33% probability of being delivered being between 7 am and 3 pm. Otherwise, this delivery will not result in a container delivery being generated in the routings file.

Dir: This is either a **1** if containers are loaded at the 'FROM' location and unloaded at the 'TO' location, or **-1** if they are unloaded at the 'FROM' location and loaded at the 'TO' location. This is used to account for empty returns for example.

1: Staging -> From(load) -> Staging-> To(unload) -> Staging

-1: Staging -> From(unload) -> Staging -> To(load) -> Staging

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Load: The load time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Unload: The unload time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Notice: there are no load or unload times for carts (or containers) that are temporarily stored in the staging area.

Strategies for creating the Deliveries file

There are 4 different formats available to define your deliveries in the Tugger Deliveries File. A delivery file can contain any combination of these formats. Each of the formats discussed below, apply for each delivery time interval for every route. (i.e. for 7am, 8am, 9am, etc. for Route 1 and Route 2 – assuming that deliveries for those routes occur every hour).

1) If a FROM, STAGE and TO location are defined, then the Tugger module will assume that the route delivery RETURN time interval includes the time from STAGING then to all of the FROM locations and then back to STAGING and then out to all of the TO locations, and finally back to STAGING. Essentially, the Tugger route generator is assuming that the material handler who is loading the carts is the same person who delivers all of the containers out in the factory.

2) If a FROM and STAGE location are defined and the TO field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the FROM locations and back to staging. Therefore, there is an implication that a different material handler is unloading these containers out into the factory, in parallel.

3) If a STAGE and TO location are defined and the FROM field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the TO locations and back to staging. Therefore, there is an implication that a different material handler is loading these containers back in the receiving area, in parallel.

4) If a FROM and TO location are defined and the STAGE field is left blank, then the Tugger module will assume that there is no staging area and that containers are being picked up at the FROM location and delivered directly to the TO location. In this situation, the Tugger route generator will sequence the deliveries in order to minimize the total distance for all pickups and deliveries.

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Step 2: Location Route Groups

Import Locs/Grps: Imports a location file that includes the route information for a tugger study.

Save Locs/Grps: Saves the location file with route information appended to it.

Route: This is the name of the route, such as tugger1, route3, etc.

Interval (hours for start and end time and minutes for departure and return intervals): This field defines the daily start and end times (in decimal hours) during which the route is being serviced. In addition, this field defines the time interval (in decimal minutes) when a route driver departs the staging area, and the amount of time that the route driver is allowed to perform the deliveries on that route before he/she must return back to the staging area.

For example:

> **7/15**/30/60 Deliveries are made on this route between 7AM-3PM.
>
> 7/15/**30/60** Deliveries are made in 30 minute intervals and the route driver has 60 minutes to complete the deliveries and return. The fact that a driver is dispatched every 30 minutes and has 60 minutes to complete their work, implies that there are two people delivering on this route, in parallel. The return time must always be equal to or greater than the interval time, and the departure time interval should be a multiple of the return time interval.

Include: This tells the Flow Planner whether or not to include the route in the study. Turning off routes is one way of speeding up the calculations when reports and diagrams for only a subset of the route drivers is desired.

Path: This is where the Passthru point sequence is defined. Passthru points are separated by forward slashes, and must be listed in the same sequence that you wish the route driver to visit those locations. Take special care to ensure that pass-thru points are located directly on an aisle path, or are “Snapped” to an aisle path intersection.

For example:

> A Passthru point sequence of **P1/P2/P3** specifies that this route’s deliveries have to pass through points P1, P2 and P3, in that order (as such, they are called Passthru points). If they do not exist, these Passthru points will be prompted for upon generation of routes. These locations should be uniquely named (different than FROM, TO or STAGE locations, and it is recommended that these names be very short. A Passthru point can appear multiple times in the path field (i.e. **P1/P2/P3/P1/P4**).
>
> Passthru points apply to BOTH the FROM to STAGE route and the STAGE to TO route. Most of the time you will be analyzing EITHER of these and thus you can simply specify the passthru points as shown above. If you are doing

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a study involving flows FROM to STAGE AND STAGE to TO, and you only want the Passthru points to apply EITHER to the FROM to STAGE or the STAGE to TO delivery, then you must prefix your Passthru point sequence with either ***F** or ***T** indicating if the list applies to the FROM portion or the TO portion of the delivery respectively. The following example, shows a Passthru point sequence that applies only to the STAGE to TO portion of the delivery ***T/P1/P2/P3.**

Volume: Represents the volume capacity (specified in cubic Meters or cubic Feet) of the tugger's carts (trailers) operating along that Route. So if you want to do tugger cart capacity using **QUANTITY of containers as opposed to VOLUME of containers**, then you will need to specify the size of each container as 12x12x12 inches (or 1000x1000x1000 millimeters) depending upon your base drawing units, so that each container is exactly one cubic foot, or meter.

The Flow Planner will first compute the quantity of containers required for storage on the carts for each route delivery. These quantities will be multiplied by the volume for each of the containers in order to compute the total requested delivery volume. You may reference the Utilizations and Reports tabs to view the comparison of the requested container volume to that of the available volume.

IMPORTANT NOTE: If the FROM to STAGING to TO format is used (described above), the program computes the Total volume of containers for the entire route, and thus will double count the required cart volume. In this case double the amount of available volume on this delivery route. A future enhancement to the software will fix this potential issue.

Eff%: This number is the packing efficiency of the tugger's carts (trailers) operating along that route. For example, a tugger with a total volume capacity of 10 cubic meters and with a packing efficiency of 80% (given the general size and shape of the containers put on the carts) would have an actual volume capacity of 8 cubic meters.

Staging Area: Normally, the staging location for a delivery is specified in the deliveries file - STAGE field. This forces the delivered part to always use that staging area, regardless of what zone driver delivers the part. Often, you may wish to have the staging area mapped to the zone driver and not to the delivered part. In this case, you simply specify the name of the Staging area for that zone driver and this will override the name of the staging area specified in that part's delivery route. It is important to note, that you still must specify a Staging location name for the delivery route in the deliveries file, even if you intend to override this name with the zone driver's staging area. In this situation, simply specify a default name (i.e. like STAGE) in the delivery file, so that the application will know that you want to route that part through a staging area.

Update: Updates any changes made to a selected route's properties.

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Step 3: Generate Routings

Tugger Name: Name of the **Method Type** that will represent the tugger routes. The **Method** name will be the Route name. As such, each tugger Route will have its own unique method.

Straight Flow: Creates routings where the shortest path between locations is determined based on Euclidean (Straight point-to-point) flows.

Aisle Flow: Creates routings where the shortest path between locations is determined based on Aisle-Based flows.

Random Seed: This value sets the start point for creating the random sample used to create the Uniform or Triangular distributions.

Append Routes: If selected, the Tugger routings will be attached to any existing flow path routings on the Routings tab instead of overwriting them.

Generate Routes: Creates the tugger routes in the Routings window for each tugger route at each departure time in which there are containers to deliver.

Staging Time: Defines the amount of time (in seconds) that all tuggers will be delayed at the staging location. In the example screen shown above, the time has been set to 60 seconds. Note this time is added once per cycle (trip out and back) and not for both the trip out and back.

Unused Deliveries

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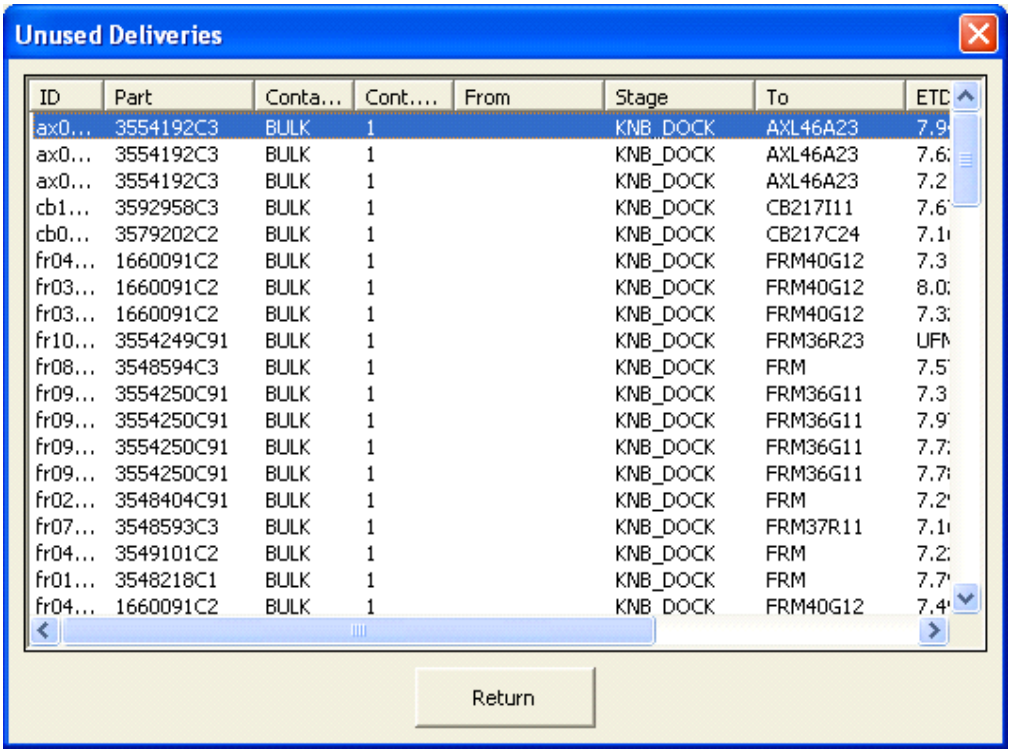

If one or more delivery lines (from the deliveries file) does not generate one, or more, corresponding routing lines, then these original delivery lines will be shown in the unused deliveries list. As with all list boxes in the Flow Planner, you may copy and paste this list into MS Excel.

This can happen if:

1) The delivery's ETD is not within its corresponding route driver service interval (i.e. start and end time)
2) The FROM and/or TO location (if specified) is not assigned to a route
3) If the delivery time was specified with a random probability of occurrence and it did not get selected by the random number generator.

Tugger Created Routing Notes

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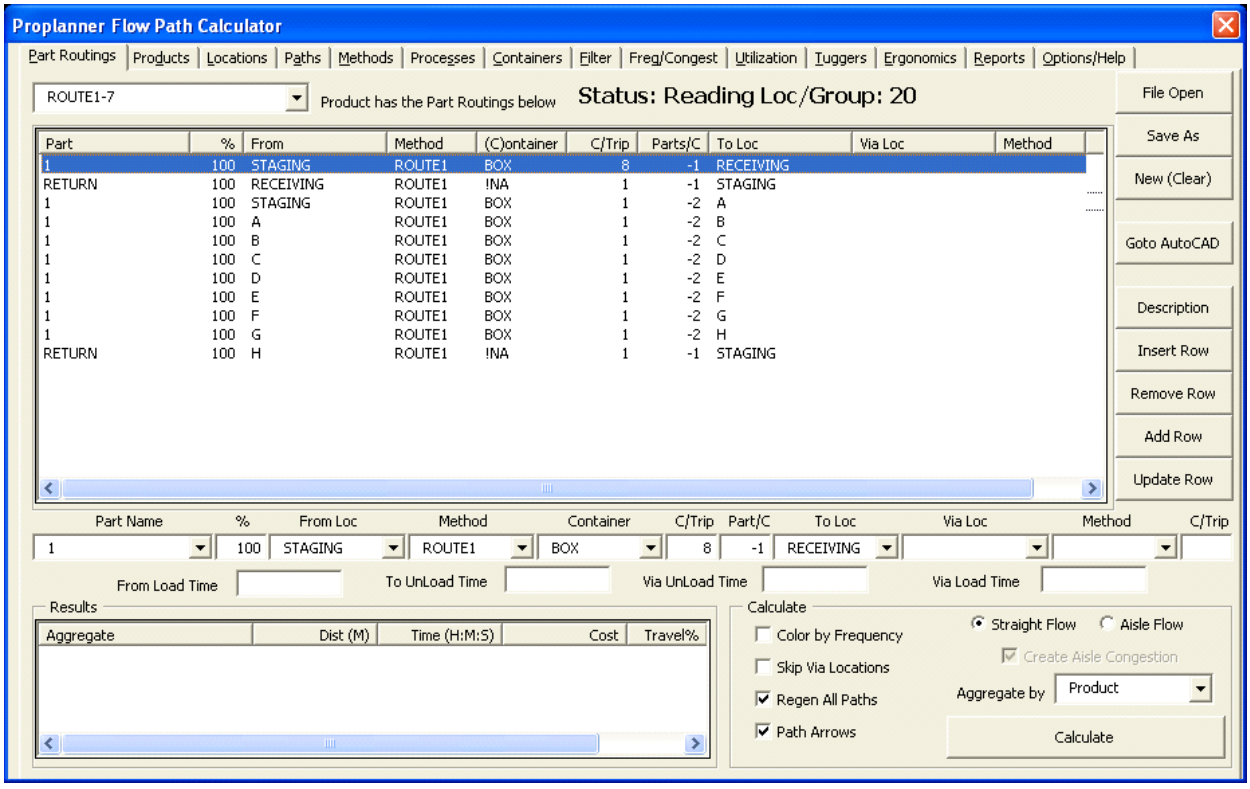

The routings generated by the Tuggers tab for the Routings tab look very different than the standard setup for the Flow Planner. We will use the simple example above to discuss the differences.

- This route makes eight deliveries of one part to eight different locations (A-H). The part name Return represents a return trip to the staging area where no load or unload time is calculated, thus the “!NA” container name. This tells the program to calculate the distance and walk time and ignore the load/unload time.
- The Tugger Module creates products that represent the tugger route name and start time (ie. Route1-7 means these are the routings for Route1 at 7AM).
- The routings themselves are broken down into their individual segments to show every load or unload at each location for the appropriate number of containers.
- Because the material handling device starts at staging and goes to the From location first, the volume is calculated for on the first routing from Staging to Receiving because it is Loading 8 containers at Receiving.
- The Parts per container are -1 to if a load is performed at the TO location and -2 when an unload is performed. This is only a signal for the program, not a value actually used for calculation.

Given this information, the example above shows the empty material handling device

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starting at Staging. It then goes to Receiving where it Loads 8 containers and returns to Staging. The next step takes it to location A-H in the shortest paths to make sure deliveries are made at the times designated on the Tuggers tab. Finally, the material handling device returns to staging where again no load/unload time is calculated because it is assumed empty at this time.

Note: The deliveries in this example were made in this order due to having sequential ETDs on the Tuggers tab. Had these been set up using Uniform or Triangular Distributions with a random seed, there is no guarantee the routes would have been scheduled at this time of day or in this order.

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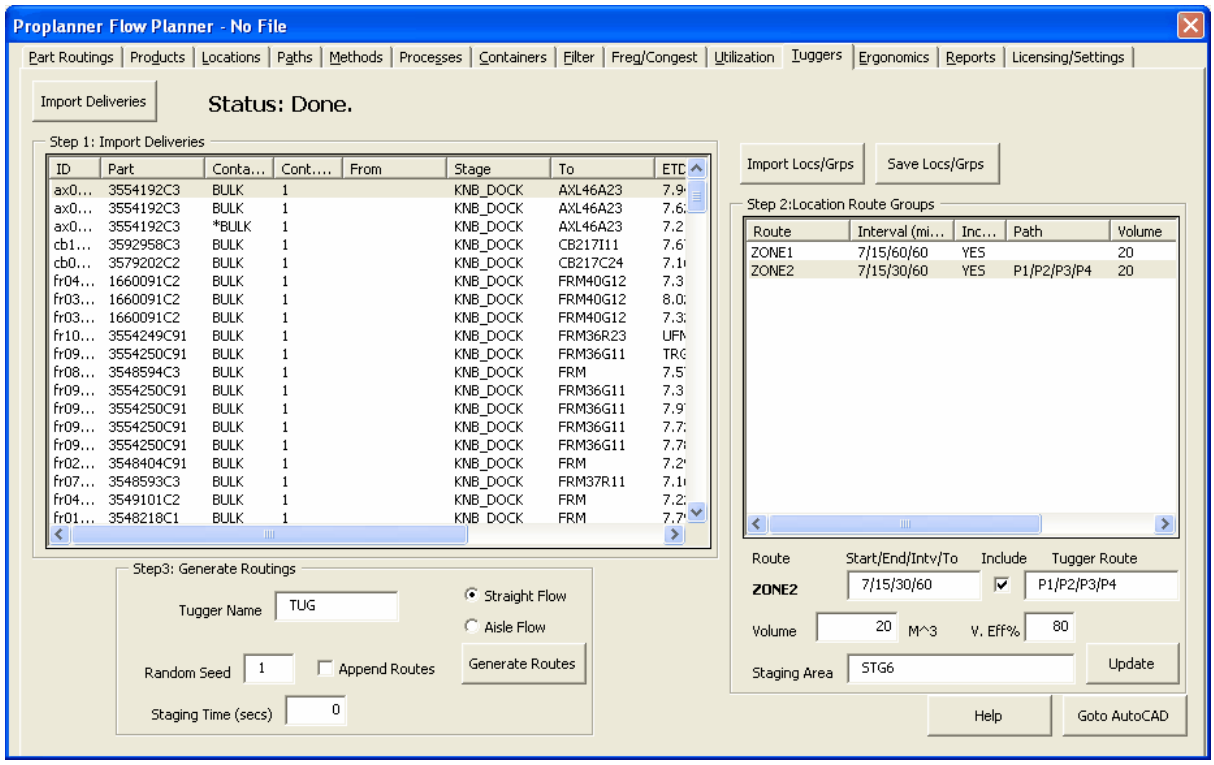
5.13.4 Tugger Created Routing Notes



Note: This tab is functional only with purchase of the Tugger add-on.

The purpose of the Tugger module is to create a set of routings to represent a mixed delivery scenario. This scenario occurs when a material handling device is used to deliver (or pick up) multiple parts to multiple locations along a shortest path route. The order in which the parts are delivered (or picked up) is determined by the tugger module such that the travel path distance (either straight, or aisle-based) is minimized and the tugger travels through each user-defined Passthru point (if any are specified) in the sequence specified in the route definition.

Step 1: Import Deliveries

Clicking the Import Deliveries button prompts the user to select a file containing delivery information for each part. An example of this file can be found in the Help Files folder. The input window where you specify your delivery file name (and also your Methods and Locations file names) is shown below.

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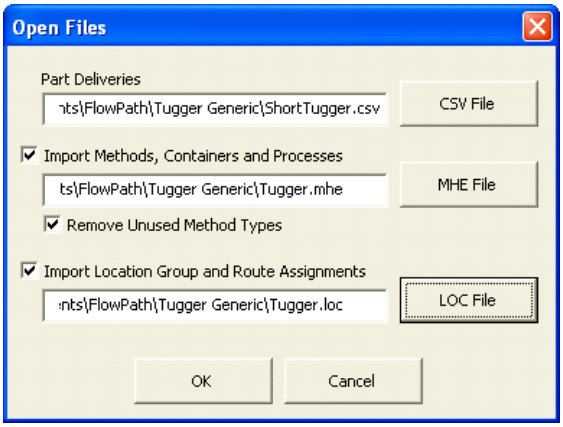

ID: Unique identifier for the delivery of this part to these locations. It is important that there be no duplicates in this field.

Part: Part name that is being moved in this delivery. This will populate the Products tab automatically.

Container: Name of the container being used to transport this part. This is tied to the size information located in the Containers tab. Container sizes are used to determine loaded container volume on the tugger's carts.

Container Qty.: Number of containers that will be delivered, **for each delivery event**, between these locations. Please reference the description on the ETD field to note a special condition with the Uniform or Triangular distribution methods.

From: Location where the part is picked up to be taken to the staging area. This could be an actual pickup location or a drop-off location. While the 'FROM' location is typically specified for loading containers; containers could also be dropped of at these locations (i.e. drop off an empty container and pick up a full one). Use the Direction field to specify if a container is being picked up (dir=1), or dropped off (dir=-1) at this 'FROM' location.

Stage: Location where the carts (trailers) are staged to be delivered to the final destination.

> **Note:** load and unload time is added (combined) at the staging area via the staging time input box at the bottom of this window.

To: Final destination of the parts. This could be an actual delivery location or in-plant drop-off locations. While the 'TO' location is typically specified for deliveries; containers could also be picked up at these locations (i.e. drop off a full container and pick up an empty one). Use the Direction field in this file to specify if a container is being picked up (dir=-1), or dropped off (dir=1) at this 'TO' location.

ETD: Sets up the time that these delivery events need to be made within the given time period. Time is input as a fixed decimal time, a randomly determined decimal time from a Uniform, or Triangular Distribution.

Decimal Time

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This is input as a number 0-23 representing the hour plus a decimal portion of that hour.

7.5 Represents a delivery being made at 7:30AM

Uniform Distribution

This allows the user to set an upper and lower bounds for the deliveries to fall between in a bell curve or uniform distribution pattern with most deliveries taking place around the median time.

UFM(7/15/3/.5) Represents a uniform distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm.

UFM(**7/15**/3/.5) This code means that deliveries are made between 7AM-3PM.

UFM(7/15/**3**/.5) Three deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

UFM(7/15/3/**.5**) They have a 50% probability of being delivered between 7 am and 3pm. Otherwise, this delivery will not result in a container delivery being scheduled in the routings file.

Triangular Distribution

Triangular is similar to the Uniform Distribution with an added third time that sets up the mean time for where the most deliveries occur.

TRG(7/15/10/2/.33) Represents a triangular distribution of deliveries. This distribution will randomly generate a delivery time between 7 am and 3 pm with a statistical preference for times around 10 am.

TRG(**7/15**/10/2/.33) This code means that deliveries are made between 7AM-3PM.

TRG(7/15/**10**/2/.33) The mean time that these deliveries is made falls at 10AM

TRG(7/15/10/**2**/.33) Two deliveries are made. Each delivery carries the Container Qty. and thus this number acts as a multiplier for the number of containers being delivered.

TRG(7/15/10/2/**.33**) They have a 33% probability of being delivered being between 7 am and 3 pm. Otherwise, this delivery will not result in a container delivery being generated in the routings file.

Dir: This is either a **1** if containers are loaded at the 'FROM' location and unloaded at the 'TO' location, or **-1** if they are unloaded at the 'FROM' location and loaded at the 'TO' location. This is used to account for empty returns for example.

1: Staging -> From(load) -> Staging-> To(unload) -> Staging

-1: Staging -> From(unload) -> Staging -> To(load) -> Staging

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Load: The load time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Unload: The unload time or code(process codes are specified on the Processes tab) being used for this part container's delivery.

Notice: there are no load or unload times for carts (or containers) that are temporarily stored in the staging area.

Strategies for creating the Deliveries file

There are 4 different formats available to define your deliveries in the Tugger Deliveries File. A delivery file can contain any combination of these formats. Each of the formats discussed below, apply for each delivery time interval for every route. (i.e. for 7am, 8am, 9am, etc. for Route 1 and Route 2 – assuming that deliveries for those routes occur every hour).

1) If a FROM, STAGE and TO location are defined, then the Tugger module will assume that the route delivery RETURN time interval includes the time from STAGING then to all of the FROM locations and then back to STAGING and then out to all of the TO locations, and finally back to STAGING. Essentially, the Tugger route generator is assuming that the material handler who is loading the carts is the same person who delivers all of the containers out in the factory.

2) If a FROM and STAGE location are defined and the TO field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the FROM locations and back to staging. Therefore, there is an implication that a different material handler is unloading these containers out into the factory, in parallel.

3) If a STAGE and TO location are defined and the FROM field is left blank, then the Tugger module will assume that the material handler is just taking carts from STAGING to all of the TO locations and back to staging. Therefore, there is an implication that a different material handler is loading these containers back in the receiving area, in parallel.

4) If a FROM and TO location are defined and the STAGE field is left blank, then the Tugger module will assume that there is no staging area and that containers are being picked up at the FROM location and delivered directly to the TO location. In this situation, the Tugger route generator will sequence the deliveries in order to minimize the total distance for all pickups and deliveries.

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Step 2: Location Route Groups

Import Locs/Grps: Imports a location file that includes the route information for a tugger study.

Save Locs/Grps: Saves the location file with route information appended to it.

Route: This is the name of the route, such as tugger1, route3, etc.

Interval (hours for start and end time and minutes for departure and return intervals): This field defines the daily start and end times (in decimal hours) during which the route is being serviced. In addition, this field defines the time interval (in decimal minutes) when a route driver departs the staging area, and the amount of time that the route driver is allowed to perform the deliveries on that route before he/she must return back to the staging area.

For example:

> **7/15**/30/60 Deliveries are made on this route between 7AM-3PM.
>
> 7/15/**30/60** Deliveries are made in 30 minute intervals and the route driver has 60 minutes to complete the deliveries and return. The fact that a driver is dispatched every 30 minutes and has 60 minutes to complete their work, implies that there are two people delivering on this route, in parallel. The return time must always be equal to or greater than the interval time, and the departure time interval should be a multiple of the return time interval.

Include: This tells the Flow Planner whether or not to include the route in the study. Turning off routes is one way of speeding up the calculations when reports and diagrams for only a subset of the route drivers is desired.

Path: This is where the Passthru point sequence is defined. Passthru points are separated by forward slashes, and must be listed in the same sequence that you wish the route driver to visit those locations. Take special care to ensure that pass-thru points are located directly on an aisle path, or are “Snapped” to an aisle path intersection.

For example:

> A Passthru point sequence of **P1/P2/P3** specifies that this route’s deliveries have to pass through points P1, P2 and P3, in that order (as such, they are called Passthru points). If they do not exist, these Passthru points will be prompted for upon generation of routes. These locations should be uniquely named (different than FROM, TO or STAGE locations, and it is recommended that these names be very short. A Passthru point can appear multiple times in the path field (i.e. **P1/P2/P3/P1/P4**).
>
> Passthru points apply to BOTH the FROM to STAGE route and the STAGE to TO route. Most of the time you will be analyzing EITHER of these and thus you can simply specify the passthru points as shown above. If you are doing

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a study involving flows FROM to STAGE AND STAGE to TO, and you only want the Passthru points to apply EITHER to the FROM to STAGE or the STAGE to TO delivery, then you must prefix your Passthru point sequence with either ***F** or ***T** indicating if the list applies to the FROM portion or the TO portion of the delivery respectively. The following example, shows a Passthru point sequence that applies only to the STAGE to TO portion of the delivery ***T/P1/P2/P3.**

Volume: Represents the volume capacity (specified in cubic Meters or cubic Feet) of the tugger's carts (trailers) operating along that Route. So if you want to do tugger cart capacity using **QUANTITY of containers as opposed to VOLUME of containers**, then you will need to specify the size of each container as 12x12x12 inches (or 1000x1000x1000 millimeters) depending upon your base drawing units, so that each container is exactly one cubic foot, or meter.

The Flow Planner will first compute the quantity of containers required for storage on the carts for each route delivery. These quantities will be multiplied by the volume for each of the containers in order to compute the total requested delivery volume. You may reference the Utilizations and Reports tabs to view the comparison of the requested container volume to that of the available volume.

IMPORTANT NOTE: If the FROM to STAGING to TO format is used (described above), the program computes the Total volume of containers for the entire route, and thus will double count the required cart volume. In this case double the amount of available volume on this delivery route. A future enhancement to the software will fix this potential issue.

Eff%: This number is the packing efficiency of the tugger's carts (trailers) operating along that route. For example, a tugger with a total volume capacity of 10 cubic meters and with a packing efficiency of 80% (given the general size and shape of the containers put on the carts) would have an actual volume capacity of 8 cubic meters.

Staging Area: Normally, the staging location for a delivery is specified in the deliveries file - STAGE field. This forces the delivered part to always use that staging area, regardless of what zone driver delivers the part. Often, you may wish to have the staging area mapped to the zone driver and not to the delivered part. In this case, you simply specify the name of the Staging area for that zone driver and this will override the name of the staging area specified in that part's delivery route. It is important to note, that you still must specify a Staging location name for the delivery route in the deliveries file, even if you intend to override this name with the zone driver's staging area. In this situation, simply specify a default name (i.e. like STAGE) in the delivery file, so that the application will know that you want to route that part through a staging area.

Update: Updates any changes made to a selected route's properties.

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Step 3: Generate Routings

Tugger Name: Name of the **Method Type** that will represent the tugger routes. The **Method** name will be the Route name. As such, each tugger Route will have its own unique method.

Straight Flow: Creates routings where the shortest path between locations is determined based on Euclidean (Straight point-to-point) flows.

Aisle Flow: Creates routings where the shortest path between locations is determined based on Aisle-Based flows.

Random Seed: This value sets the start point for creating the random sample used to create the Uniform or Triangular distributions.

Append Routes: If selected, the Tugger routings will be attached to any existing flow path routings on the Routings tab instead of overwriting them.

Generate Routes: Creates the tugger routes in the Routings window for each tugger route at each departure time in which there are containers to deliver.

Staging Time: Defines the amount of time (in seconds) that all tuggers will be delayed at the staging location. In the example screen shown above, the time has been set to 60 seconds. Note this time is added once per cycle (trip out and back) and not for both the trip out and back.

Unused Deliveries

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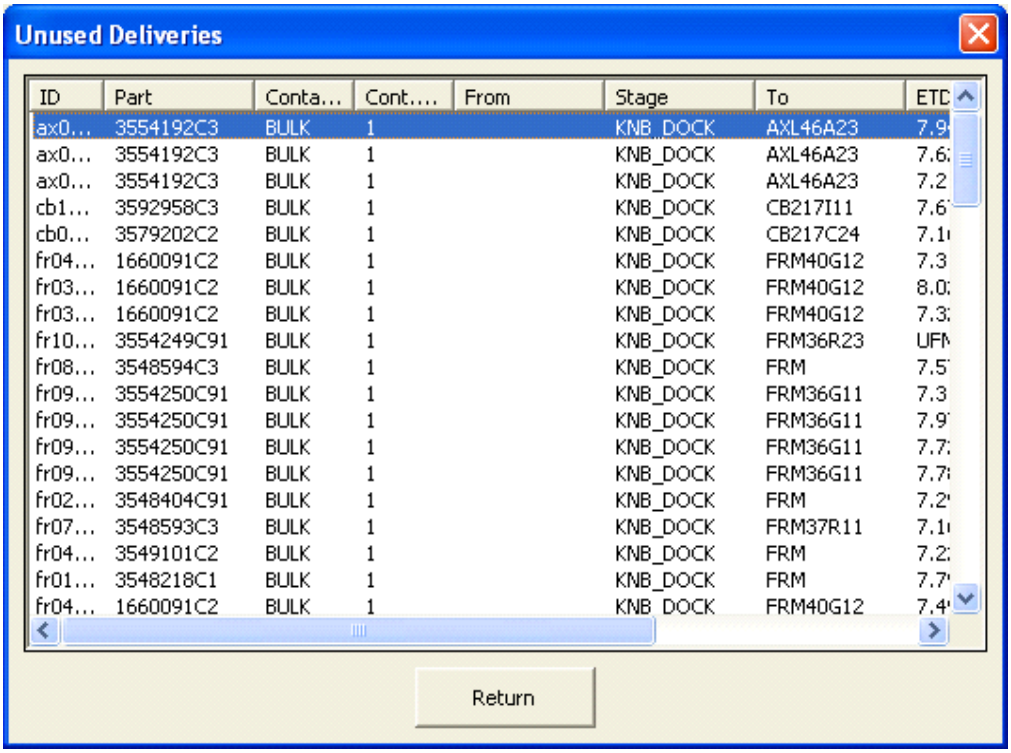

If one or more delivery lines (from the deliveries file) does not generate one, or more, corresponding routing lines, then these original delivery lines will be shown in the unused deliveries list. As with all list boxes in the Flow Planner, you may copy and paste this list into MS Excel.

This can happen if:

1) The delivery's ETD is not within its corresponding route driver service interval (i.e. start and end time)
2) The FROM and/or TO location (if specified) is not assigned to a route
3) If the delivery time was specified with a random probability of occurrence and it did not get selected by the random number generator.

Tugger Created Routing Notes

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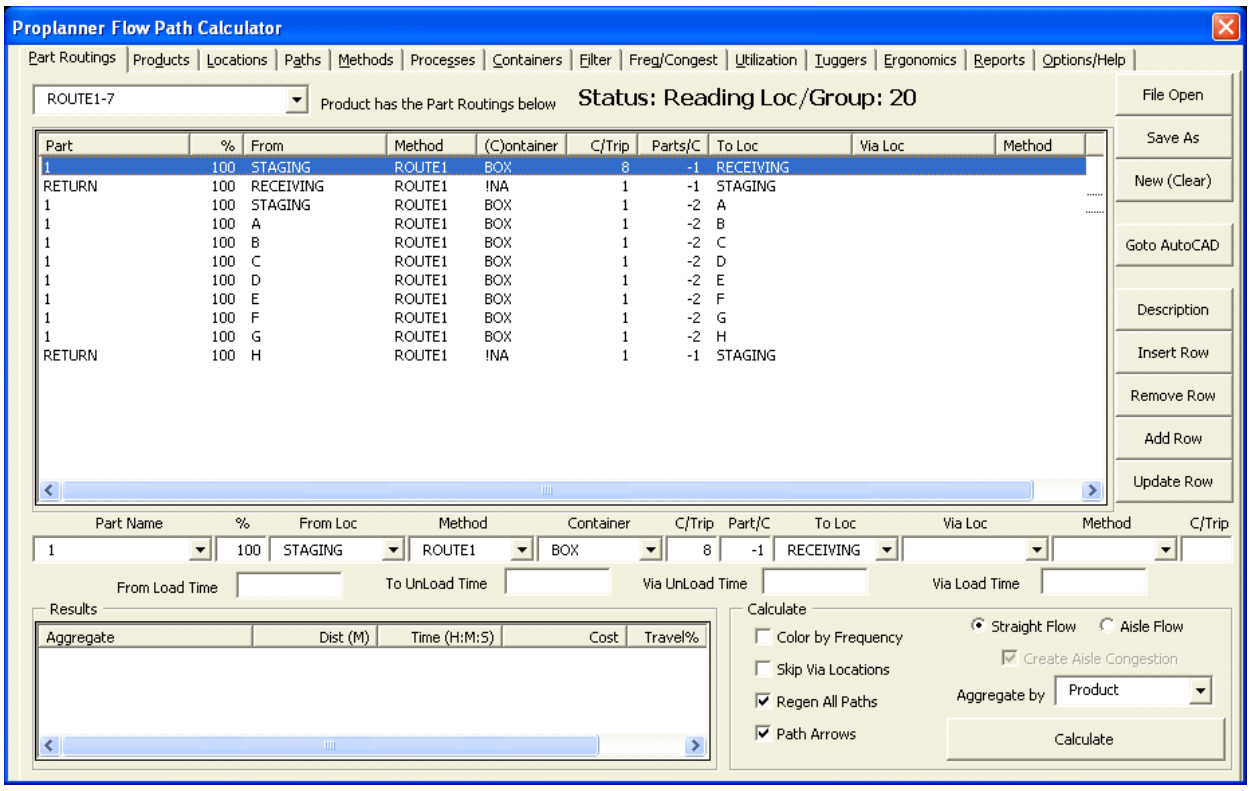

The routings generated by the Tuggers tab for the Routings tab look very different than the standard setup for the Flow Planner. We will use the simple example above to discuss the differences.

- This route makes eight deliveries of one part to eight different locations (A-H). The part name Return represents a return trip to the staging area where no load or unload time is calculated, thus the “!NA” container name. This tells the program to calculate the distance and walk time and ignore the load/unload time.
- The Tugger Module creates products that represent the tugger route name and start time (ie. Route1-7 means these are the routings for Route1 at 7AM).
- The routings themselves are broken down into their individual segments to show every load or unload at each location for the appropriate number of containers.
- Because the material handling device starts at staging and goes to the From location first, the volume is calculated for on the first routing from Staging to Receiving because it is Loading 8 containers at Receiving.
- The Parts per container are -1 to if a load is performed at the TO location and -2 when an unload is performed. This is only a signal for the program, not a value actually used for calculation.

Given this information, the example above shows the empty material handling device

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starting at Staging. It then goes to Receiving where it Loads 8 containers and returns to Staging. The next step takes it to location A-H in the shortest paths to make sure deliveries are made at the times designated on the Tuggers tab. Finally, the material handling device returns to staging where again no load/unload time is calculated because it is assumed empty at this time.

Note: The deliveries in this example were made in this order due to having sequential ETDs on the Tuggers tab. Had these been set up using Uniform or Triangular Distributions with a random seed, there is no guarantee the routes would have been scheduled at this time of day or in this order.

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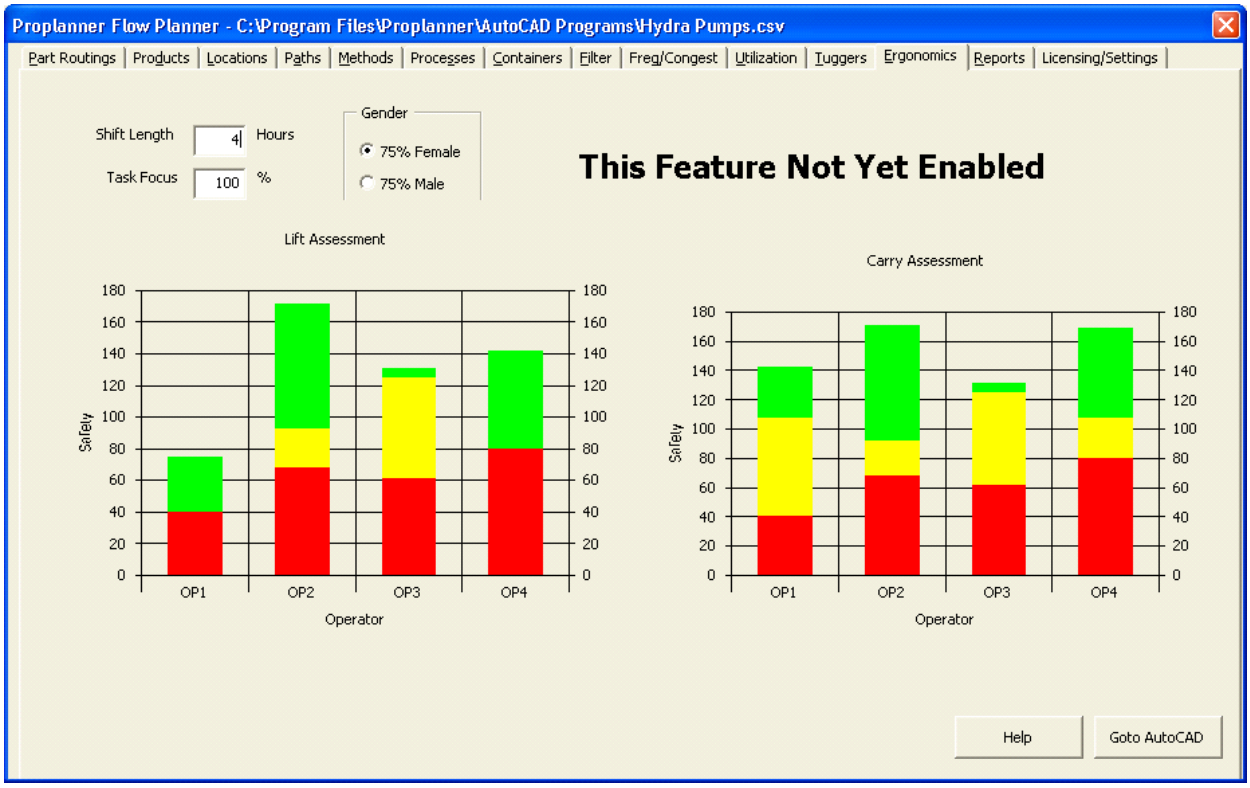
5.14 Ergonomics Tab



The Ergonomics tab charts the operator safety for the Lift and Carry tasks involving weight and posture defined within the routings. The FP uses the "SNOOK" tables developed by Liberty Mutual Insurance in 1991 and approved by OSHA. The FP allows the user to compute results for both 75% Females and 75% Males.

SHIFT LENGTH – The SNOOK tables require a number of cycles (or repetitions) of the routing performed over a given period of time. The Shift length determines the total duration of time during which the routing is performed. Together with the Task Focus (defined below), and the load/unload time, the FP is able to determine the number of repetitions per day over the shift length time to determine the safety of the task.

TASK FOCUS – The task focus defines the percentage of time during the shift that the operator is performing the activities defined in the routing. For example, if the operator is working an 8 hour shift (as defined in the shift length), but only performs the routing cycle ½ of the time during this shift, then the Task Focus value would be 50 to represent 50%.

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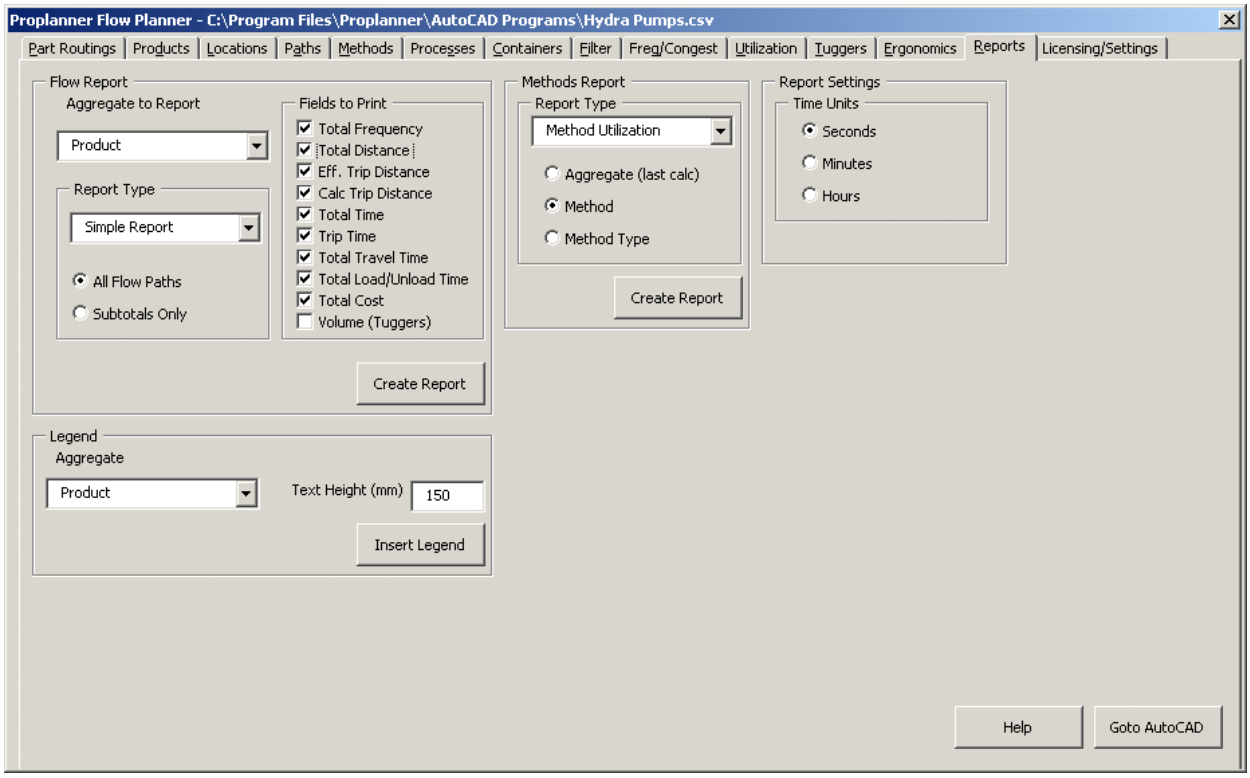
5.15 Reports Tab



The Reports window is an interface for creating an XML based spreadsheet output that is pre-formatted with the Path output information desired by the user. This setup allows for easy printing, viewing, and sending to other programs such as Excel for further evaluation.

Once the report is generated, you can hit ctrl+A to select all and copy and paste the information into Excel for a preformatted and editable Excel file. Right clicking on the data will give the option to export to Excel as a non formatted and editable Excel table.

Flow Report

Aggregate to Report – Selects which aggregate type to display the path information for.

Report type – Chooses the report type from a pull-down list. Here you can also designate whether All Flow Paths or their Subtotals only are displayed.

Fields to Print – This column selects which data sets to display in the final reports. The reports will automatically be resized and formatted to allow for any combination of this information desired.

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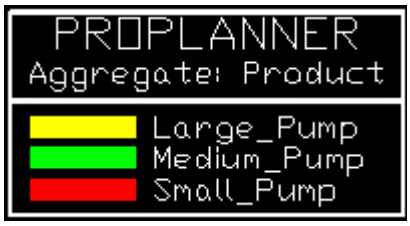
Create Report – Generates the XML report in a browser window. You may have to tell Windows to allow the active content if using Windows XP service pack 2 or higher.

Legend

Creates a legend that identifies flow paths by aggregate color shown below. The user designates the default size and selects the insertion point within the drawing. This legend can be resized by selecting it's height from the reports tab or using the scale command within AutoCAD.



Once the legend has been placed for that aggregation method, it will automatically update with any changes made in a calculation or of desired line color. It must be placed once for the aggregation type chosen but will remain there for future viewing. It will not automatically appear for all aggregate methods if placed for only one but will remain for those methods once placed.

Methods Report

Creates a report that will display quantity, travel time, load/unload time, total time, available time/quantity, and the utilization percentage. This can be set to be displayed for the last aggregation method, Method, or Method Type.

Report Settings

Time Units – Selects the default time units to display the output information in. Conversions will automatically be made if this unit is different than the input unit designated in the routings.

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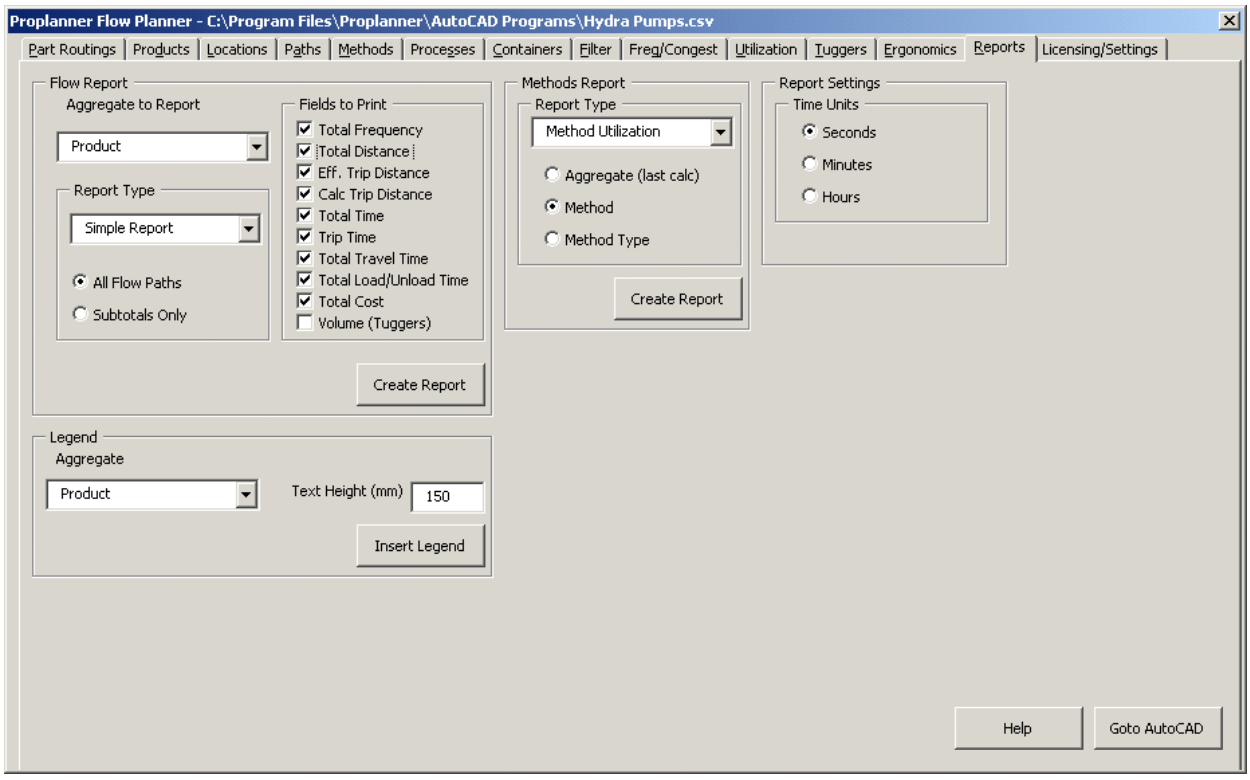
5.15.1 Flow Report



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Flow Report

Aggregate to Report – Selects which aggregate type to display the path information for.

Report type – Chooses the report type from a pull-down list. Here you can also designate whether All Flow Paths or their Subtotals only are displayed.

Fields to Print – This column selects which data sets to display in the final reports. The reports will automatically be resized and formatted to allow for any combination of this information desired.

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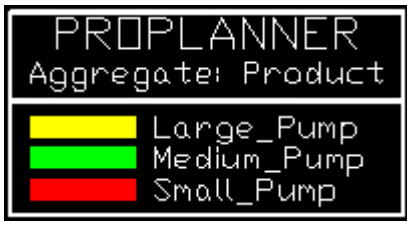

Once the legend has been placed for that aggregation method, it will automatically update with any changes made in a calculation or of desired line color. It must be placed once for the aggregation type chosen but will remain there for future viewing. It will not automatically appear for all aggregate methods if placed for only one but will remain for those methods once placed.

Methods Report

Creates a report that will display quantity, travel time, load/unload time, total time, available time/quantity, and the utilization percentage. This can be set to be displayed for the last aggregation method, Method, or Method Type.

Report Settings

Time Units – Selects the default time units to display the output information in. Conversions will automatically be made if this unit is different than the input unit designated in the routings.

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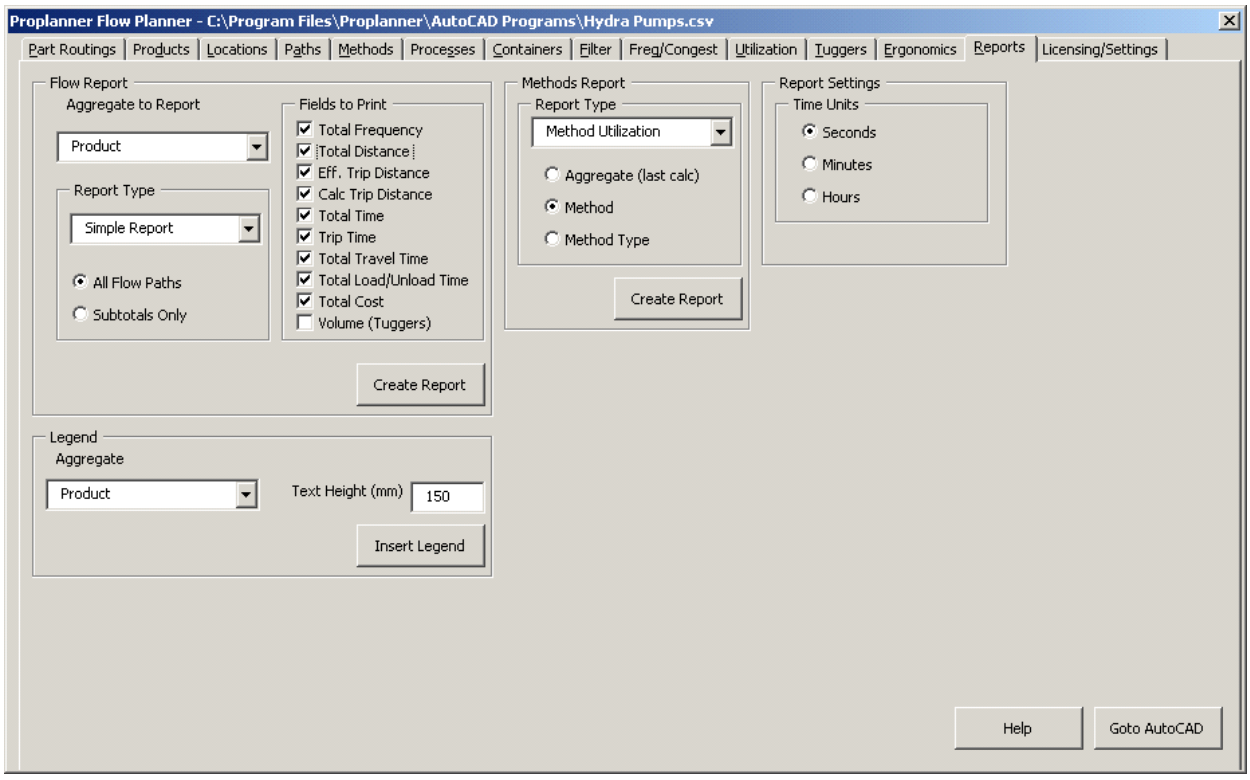
5.15.2 Legend



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Flow Report

Aggregate to Report – Selects which aggregate type to display the path information for.

Report type – Chooses the report type from a pull-down list. Here you can also designate whether All Flow Paths or their Subtotals only are displayed.

Fields to Print – This column selects which data sets to display in the final reports. The reports will automatically be resized and formatted to allow for any combination of this information desired.

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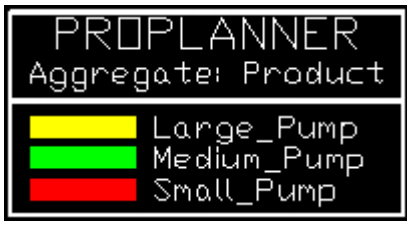

Once the legend has been placed for that aggregation method, it will automatically update with any changes made in a calculation or of desired line color. It must be placed once for the aggregation type chosen but will remain there for future viewing. It will not automatically appear for all aggregate methods if placed for only one but will remain for those methods once placed.

Methods Report

Creates a report that will display quantity, travel time, load/unload time, total time, available time/quantity, and the utilization percentage. This can be set to be displayed for the last aggregation method, Method, or Method Type.

Report Settings

Time Units – Selects the default time units to display the output information in. Conversions will automatically be made if this unit is different than the input unit designated in the routings.

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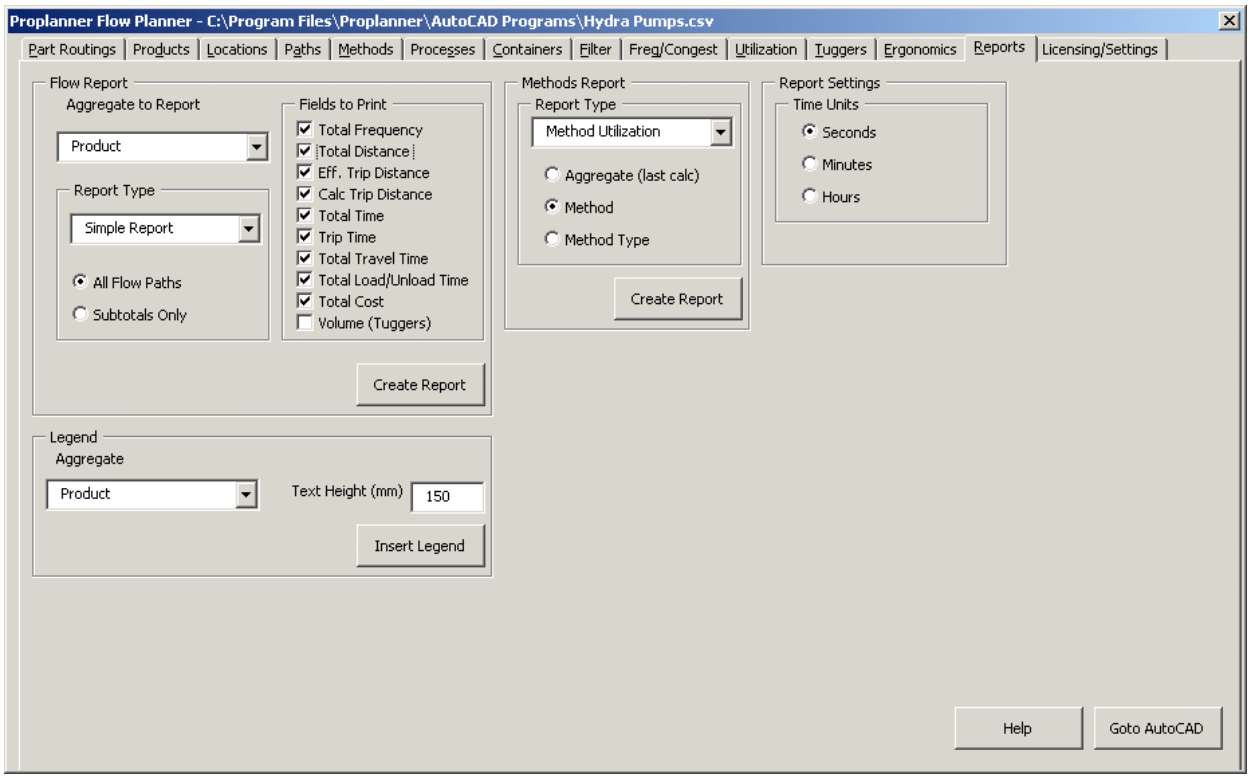
5.15.3 Methods Report



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Flow Report

Aggregate to Report – Selects which aggregate type to display the path information for.

Report type – Chooses the report type from a pull-down list. Here you can also designate whether All Flow Paths or their Subtotals only are displayed.

Fields to Print – This column selects which data sets to display in the final reports. The reports will automatically be resized and formatted to allow for any combination of this information desired.

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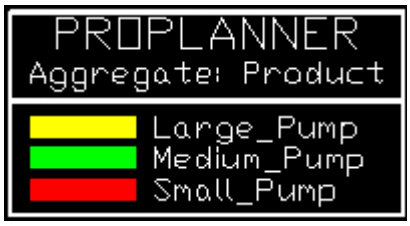
Legend

Creates a legend that identifies flow paths by aggregate color shown below. The user designates the default size and selects the insertion point within the drawing. This legend can be resized by selecting it's height from the reports tab or using the scale command within AutoCAD.



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Methods Report

Creates a report that will display quantity, travel time, load/unload time, total time, available time/quantity, and the utilization percentage. This can be set to be displayed for the last aggregation method, Method, or Method Type.

Report Settings

Time Units – Selects the default time units to display the output information in. Conversions will automatically be made if this unit is different than the input unit designated in the routings.

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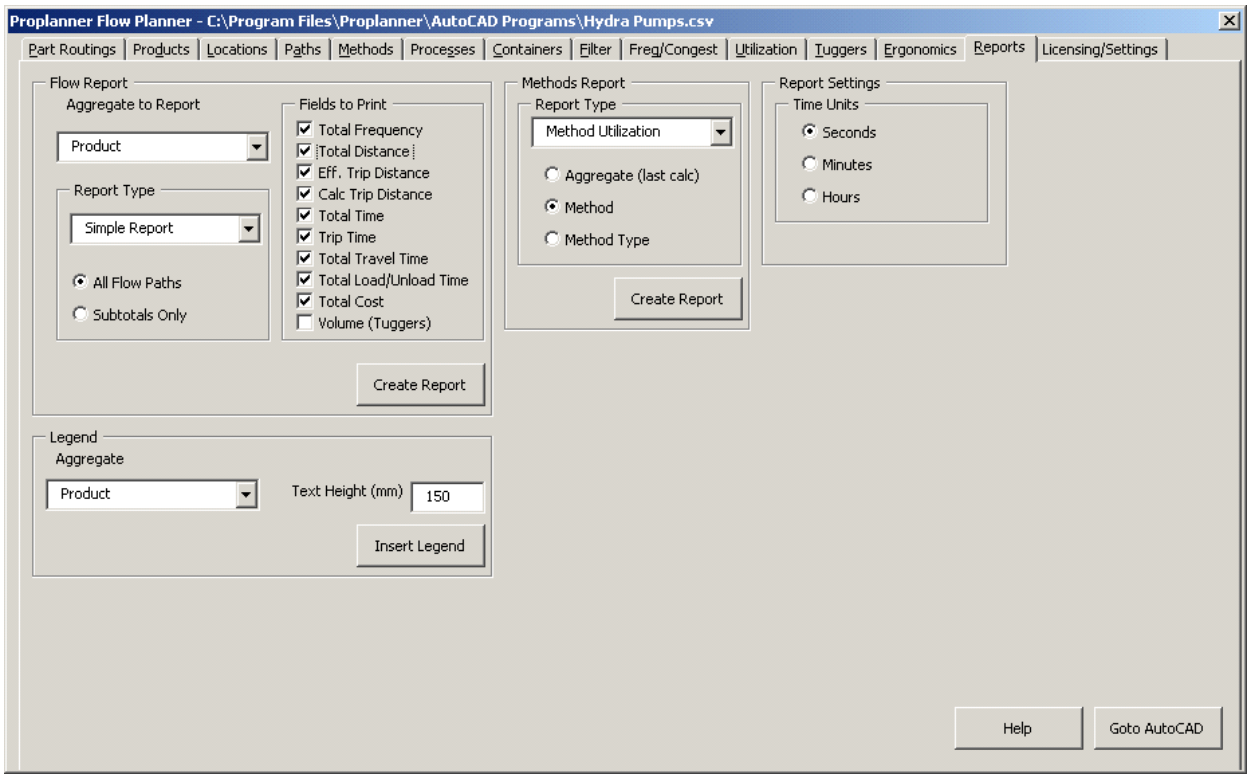
5.15.4 Report Settings



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Once the report is generated, you can hit ctrl+A to select all and copy and paste the information into Excel for a preformatted and editable Excel file. Right clicking on the data will give the option to export to Excel as a non formatted and editable Excel table.

Flow Report

Aggregate to Report – Selects which aggregate type to display the path information for.

Report type – Chooses the report type from a pull-down list. Here you can also designate whether All Flow Paths or their Subtotals only are displayed.

Fields to Print – This column selects which data sets to display in the final reports. The reports will automatically be resized and formatted to allow for any combination of this information desired.

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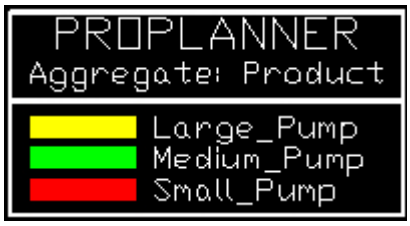
Create Report – Generates the XML report in a browser window. You may have to tell Windows to allow the active content if using Windows XP service pack 2 or higher.

Legend

Creates a legend that identifies flow paths by aggregate color shown below. The user designates the default size and selects the insertion point within the drawing. This legend can be resized by selecting it's height from the reports tab or using the scale command within AutoCAD.



Once the legend has been placed for that aggregation method, it will automatically update with any changes made in a calculation or of desired line color. It must be placed once for the aggregation type chosen but will remain there for future viewing. It will not automatically appear for all aggregate methods if placed for only one but will remain for those methods once placed.

Methods Report

Creates a report that will display quantity, travel time, load/unload time, total time, available time/quantity, and the utilization percentage. This can be set to be displayed for the last aggregation method, Method, or Method Type.

Report Settings

Time Units – Selects the default time units to display the output information in. Conversions will automatically be made if this unit is different than the input unit designated in the routings.

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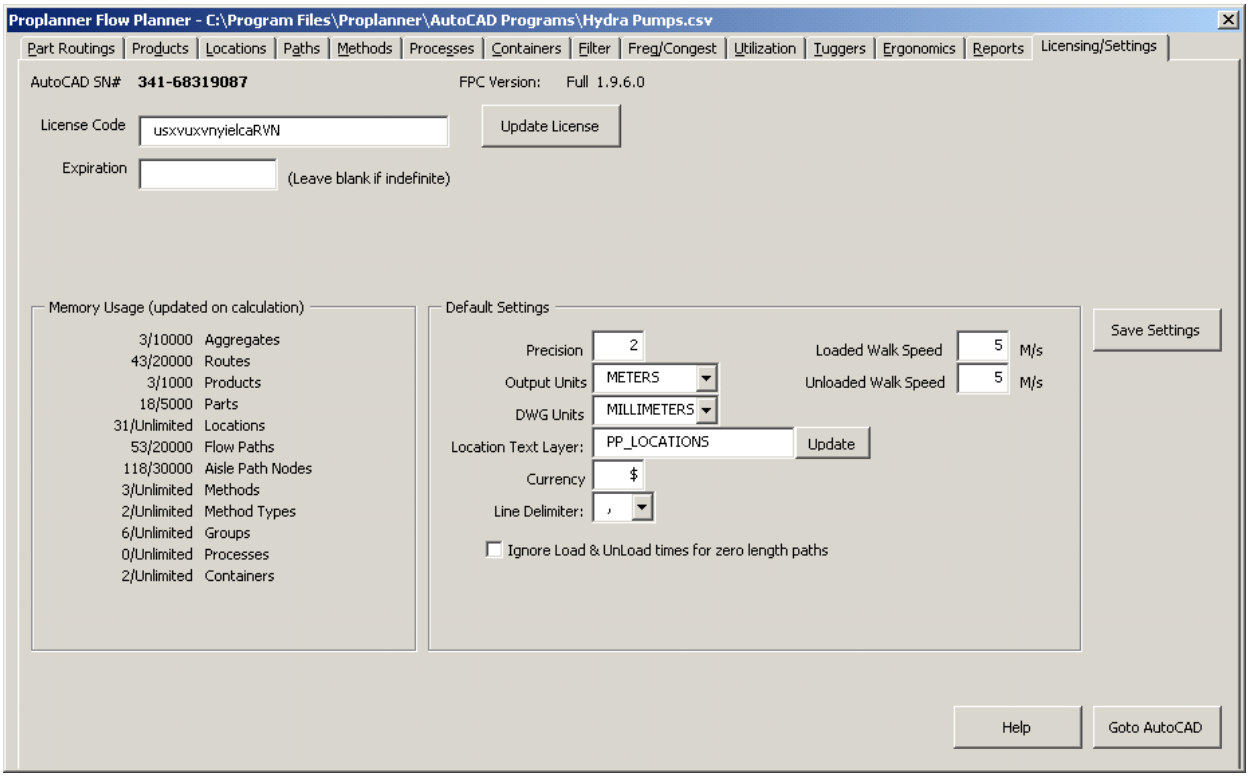
5.16 Licensing/Settings Tab



For Proplanner Applications working on an existing AutoCAD License

When you first run the application you will need to go to the **Licensing/Settings** tab and enter your License Code. License codes are provided by your Proplanner sales representative, or can also be obtained by contacting Technical Support. License codes are generated to link the FP to your copy of AutoCAD. Therefore you will need to provide the Proplanner representative with your AutoCAD serial number (shown on the options screen) so that they can generate the appropriate code for you.

Upon entering the code and selecting the Update License button, the WPP will save this code to a license file in the WPP application directory specified at installation time.

Precision*:* Determines the desired number of decimal places to show for results

Output Units *(Feet/Meters):* Determines the desired output units for the results and paths windows, as well as the basis for method type speed.

Base Drawing Units (*Inches/Feet/millimeters/Meters):* Determines the value of one unit of distance in the drawing. This is used for extracting travel distances

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between locations and for paths extracted from the drawing.

Location Text Layer: Designates the layer on which the location information is stored. This can be changed to save different location settings on the same drawing.

Currency: the currency used in Proplanner FP

Loaded Walk Speed: the speed used in FP for loaded walk

Unloaded Walk Speed: the speed used in FP for unloaded walk

Line Delimiter: This setting allows the user to select either the comma or semi-colon for the delimiter it uses to separate information in the input files. The default comma separated files are not always standard for foreign numeric notations that use commas instead of periods.

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6 Tutorial

There are two tutorials helping you get familiar with Proplanner FlowPlanner:

Hydra Pumps Example
Tugger add-on Tutorial

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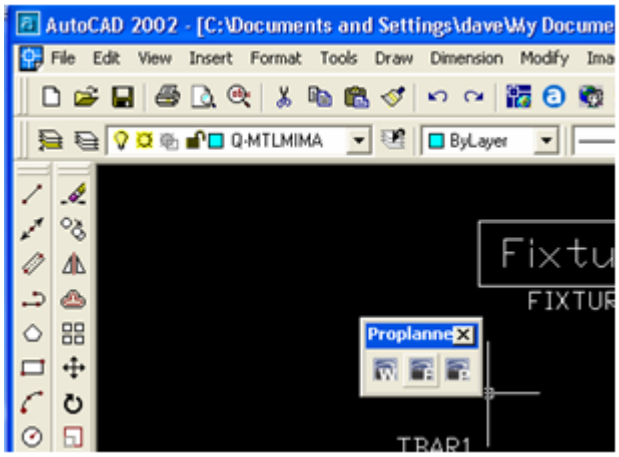
6.1 Hydra Pumps Example

STEP 1: To get started, run AutoCAD and Open the file HydraPumps.DWG. You should be able to see the Proplanner Applications menu on your screen. If not, you will need to load this menu using the Menu Installation Guide titled Install.pdf.



STEP 2: Select the "F" Proplanner icon button, and when the FP application loads it will present an intro screen similar to that shown below. Simply clicking anywhere on this screen will load the main FP application window.

STEP 3: To import an existing flow routing file, select the File Open button from the top right corner of the Part Routings tab that comes up when the program first starts. Then select the Hydra Pumps. CSV file provided with the FP application. This can most commonly be found in "C:\Program Files\Proplanner\AutoCAD Programs". Once the file is selected, click OK to load the sample file.

STEP 4: Part Routings

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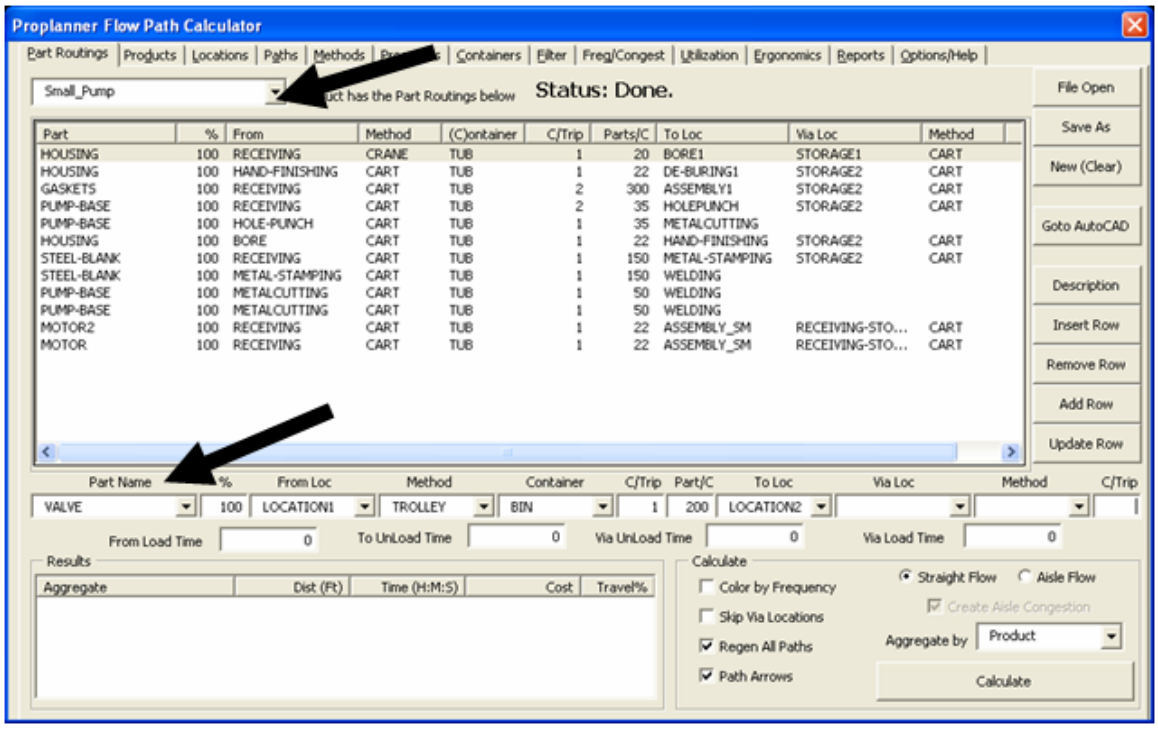
Note that the “Small Pump” will already be selected from the list of products available in the top left pull-down menu.

Next, input routing information into the input boxes shown by the arrow below.

Give the following details for the Part Routing

Part name = “VALVE”
% = “100”
From Loc = “LOCATION1”
Method = “TROLLEY”
Container = “BIN”
C/Trip = “1”
Part/C = “200”
To Loc = “LOCATION2”

Make the other three fields empty



Click on the “Add Row” to the right after entering these values.

The added row is outlined. Now click on “Insert Row”. The information for VALVE is inserted above the previously highlighted row.

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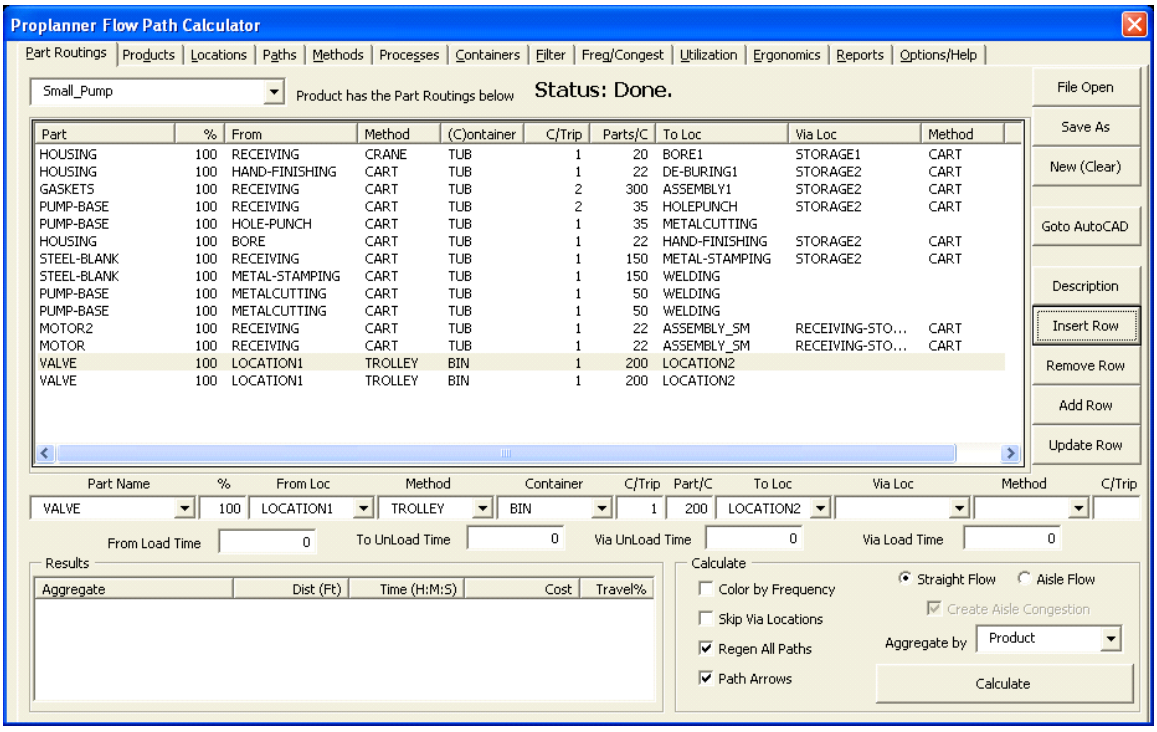
Proplanner Flow Path Calculator
Part Routings
Products
Locations
Paths
Methods
Processes
Containers
Filter
Freq/Congest
Utilization
Ergonomics
Reports
Options/Help
Small_Pump
Product has the Part Routings below
Status: Done.
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Insert Row
Remove Row
Add Row
Update Row
Part % From Method (C)ontainer C/Trip Parts/C To Loc Via Loc Method
HOUSING 100 RECEIVING CRANE TUB 1 20 BORE1 STORAGE1 CART
HOUSING 100 HAND-FINISHING CART TUB 1 22 DE-BURING1 STORAGE2 CART
GASKETS 100 RECEIVING CART TUB 2 300 ASSEMBLY1 STORAGE2 CART
PUMP-BASE 100 RECEIVING CART TUB 2 35 HOLEPUNCH STORAGE2 CART
PUMP-BASE 100 HOLE-PUNCH CART TUB 1 35 METALCUTTING
HOUSING 100 BORE CART TUB 1 22 HAND-FINISHING STORAGE2 CART
STEEL-BLANK 100 RECEIVING CART TUB 1 150 METAL-STAMPING STORAGE2 CART
STEEL-BLANK 100 METAL-STAMPING CART TUB 1 150 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
MOTOR2 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
MOTOR 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
VALVE 100 LOCATION1 TROLLEY BIN 1 200 LOCATION2
VALVE 100 LOCATION1 TROLLEY BIN 1 200 LOCATION2
Part Name % From Loc Method Container C/Trip Part/C To Loc Via Loc Method C/Trip
VALVE 100 LOCATION1 TROLLEY BIN 1 200 LOCATION2
From Load Time 0
To UnLoad Time 0
Via UnLoad Time 0
Via Load Time 0
Results
Aggregate Dist (Ft) Time (H:M:S) Cost Travel%
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by Product
Calculate

Change only the following details in the inserted row and hit Update.

Part Name = “BASEPLATE”
From Loc = “LOCATION3”
To Loc = “LOCATION4”
Part/C = “100”

Select the added row now and now click on the Update Row button. This will update the row with the same information as the inserted row so that both new rows are alike. This was just to get you familiar with the update function.

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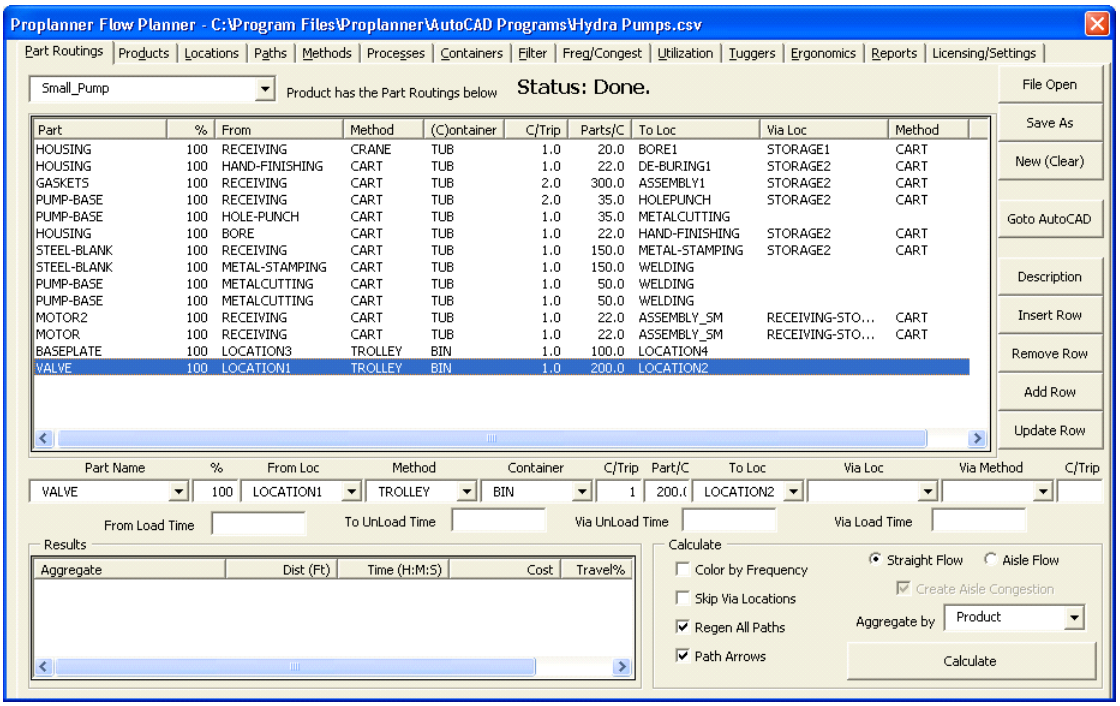
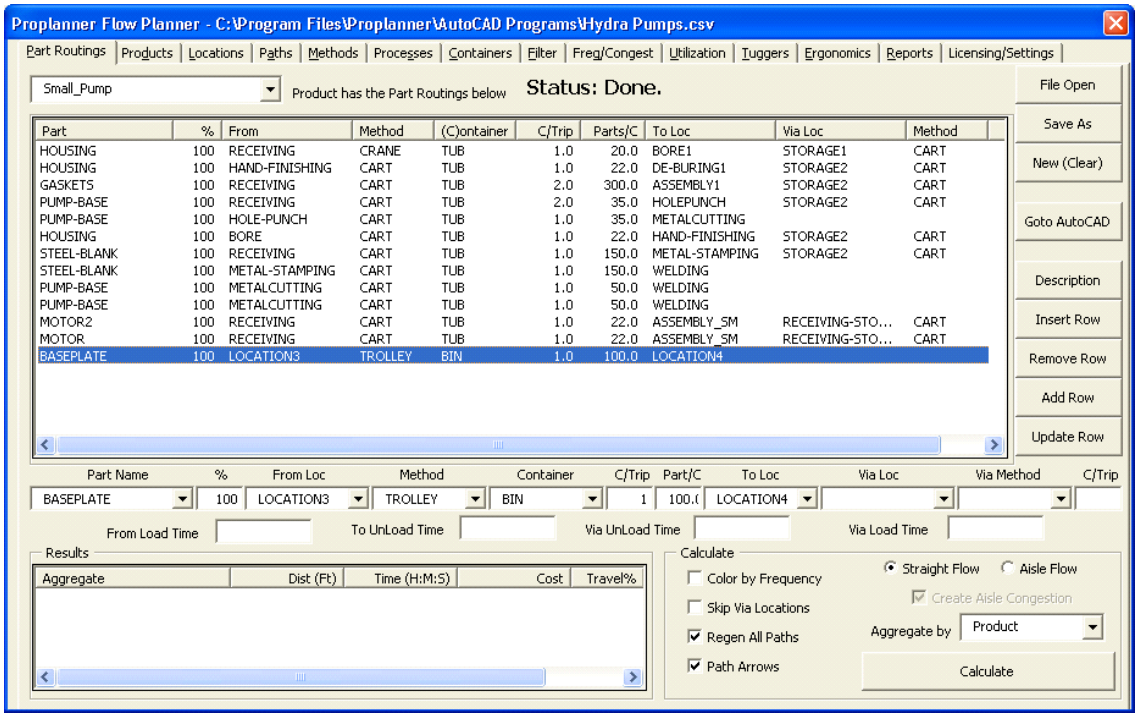

Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Small_Pump
Product has the Part Routings below
Status: Done.
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Insert Row
Remove Row
Add Row
Update Row
Part | % | From | Method | (C)ontainer | C/Trip | Parts/C | To Loc | Via Loc | Method
HOUSING 100 RECEIVING CRANE TUB 1.0 20.0 BORE1 STORAGE1 CART
HOUSING 100 HAND-FINISHING CART TUB 1.0 22.0 DE-BURING1 STORAGE2 CART
GASKETS 100 RECEIVING CART TUB 2.0 300.0 ASSEMBLY1 STORAGE2 CART
PUMP-BASE 100 RECEIVING CART TUB 2.0 35.0 HOLEPUNCH STORAGE2 CART
PUMP-BASE 100 HOLE-PUNCH CART TUB 1.0 35.0 METALCUTTING
HOUSING 100 BORE CART TUB 1.0 22.0 HAND-FINISHING STORAGE2 CART
STEEL-BLANK 100 RECEIVING CART TUB 1.0 150.0 METAL-STAMPING STORAGE2 CART
STEEL-BLANK 100 METAL-STAMPING CART TUB 1.0 150.0 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1.0 50.0 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1.0 50.0 WELDING
MOTOR2 100 RECEIVING CART TUB 1.0 22.0 ASSEMBLY_SM RECEIVING-STO... CART
MOTOR 100 RECEIVING CART TUB 1.0 22.0 ASSEMBLY_SM RECEIVING-STO... CART
BASEPLATE 100 LOCATION3 TROLLEY BIN 1.0 100.0 LOCATION4
VALVE 100 LOCATION1 TROLLEY BIN 1.0 200.0 LOCATION2
Part Name | % | From Loc | Method | Container | C/Trip | Part/C | To Loc | Via Loc | Via Method | C/Trip
VALVE 100 LOCATION1 TROLLEY BIN 1 200.(LOCATION2
From Load Time
To UnLoad Time
Via UnLoad Time
Via Load Time
Results
Aggregate | Dist (Ft) | Time (H:M:S) | Cost | Travel%
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by
Product
Calculate

Now we select the last row “VALVE”, and click “Remove Row”. This will leave us with the following:


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Small_Pump
Product has the Part Routings below
Status: Done.
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Insert Row
Remove Row
Add Row
Update Row
Part | % | From | Method | (C)ontainer | C/Trip | Parts/C | To Loc | Via Loc | Method
HOUSING 100 RECEIVING CRANE TUB 1.0 20.0 BORE1 STORAGE1 CART
HOUSING 100 HAND-FINISHING CART TUB 1.0 22.0 DE-BURING1 STORAGE2 CART
GASKETS 100 RECEIVING CART TUB 2.0 300.0 ASSEMBLY1 STORAGE2 CART
PUMP-BASE 100 RECEIVING CART TUB 2.0 35.0 HOLEPUNCH STORAGE2 CART
PUMP-BASE 100 HOLE-PUNCH CART TUB 1.0 35.0 METALCUTTING
HOUSING 100 BORE CART TUB 1.0 22.0 HAND-FINISHING STORAGE2 CART
STEEL-BLANK 100 RECEIVING CART TUB 1.0 150.0 METAL-STAMPING STORAGE2 CART
STEEL-BLANK 100 METAL-STAMPING CART TUB 1.0 150.0 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1.0 50.0 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1.0 50.0 WELDING
MOTOR2 100 RECEIVING CART TUB 1.0 22.0 ASSEMBLY_SM RECEIVING-STO... CART
MOTOR 100 RECEIVING CART TUB 1.0 22.0 ASSEMBLY_SM RECEIVING-STO... CART
BASEPLATE 100 LOCATION3 TROLLEY BIN 1.0 100.0 LOCATION4
Part Name | % | From Loc | Method | Container | C/Trip | Part/C | To Loc | Via Loc | Via Method | C/Trip
BASEPLATE 100 LOCATION3 TROLLEY BIN 1 100.(LOCATION4
From Load Time
To UnLoad Time
Via UnLoad Time
Via Load Time
Results
Aggregate | Dist (Ft) | Time (H:M:S) | Cost | Travel%
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by
Product
Calculate

Click on the “Calculate” button. A Flow Path Alert message shows up

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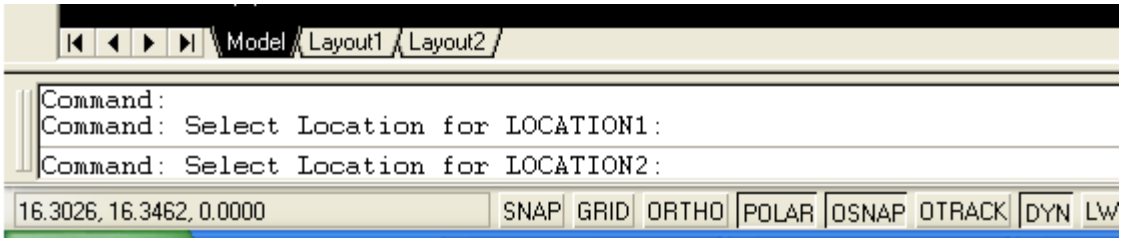
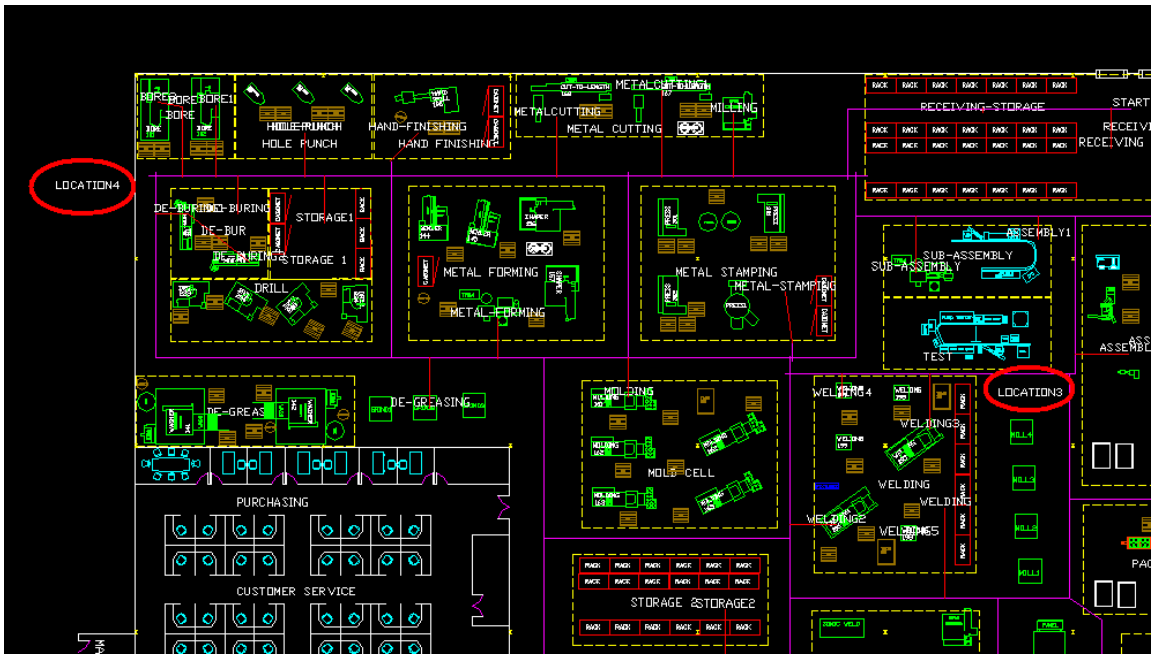
Click OK. At the command line of AutoCAD you will note a prompt for adding the location.



Add Location1, Location 2 anywhere on the drawing. For locations 3 and 4 refer to the image below and add them as shown. [NOTE: red circles will not appear in the drawing. You can remove Location 1 and Location 2 in the locations Tab later since they are not needed now.]



After entering Location 4 the paths are drawn on the AutoCAD drawing. At this stage click on "Return to Flow Path Calc" to get back to the application.

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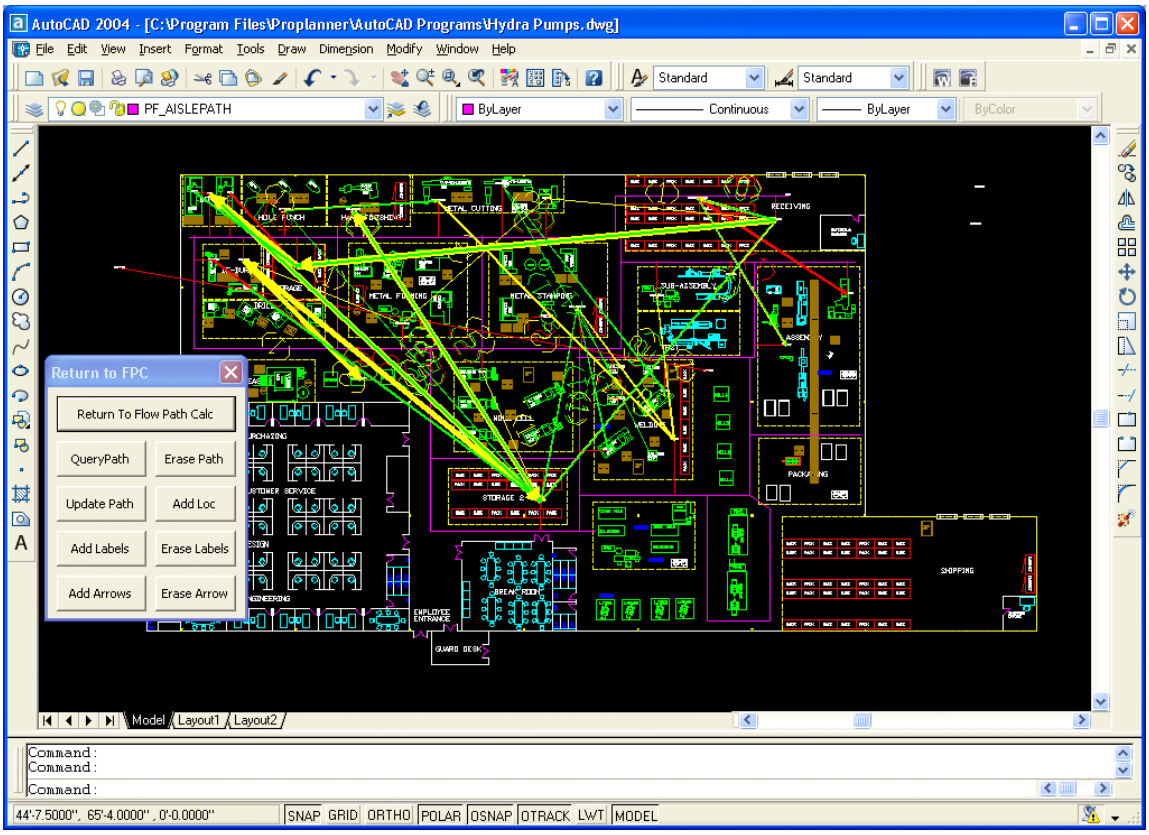
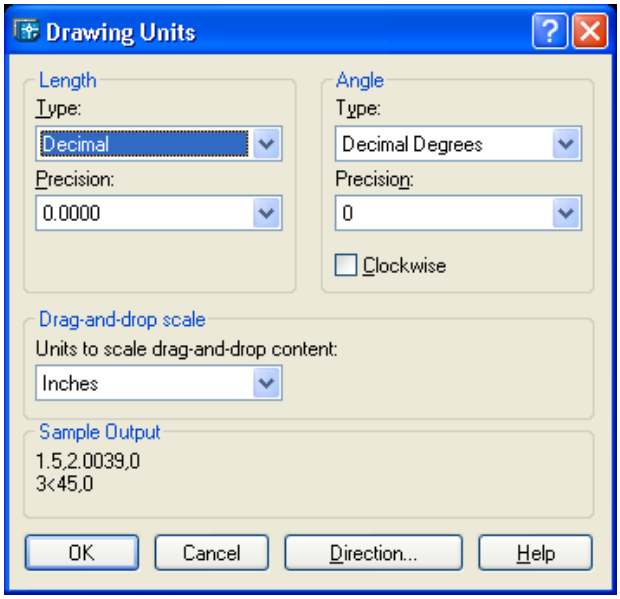


Special Note: if the drawing shows very big arrows overlapping each other after you click the “Calculate” button. It is probably the units of the drawing and the units used by Flow Planner are different. You can type in "units" in the command line and see the drawing units. Then go to "Licensing/Settings" Tab to change the units used by Flow Planner.



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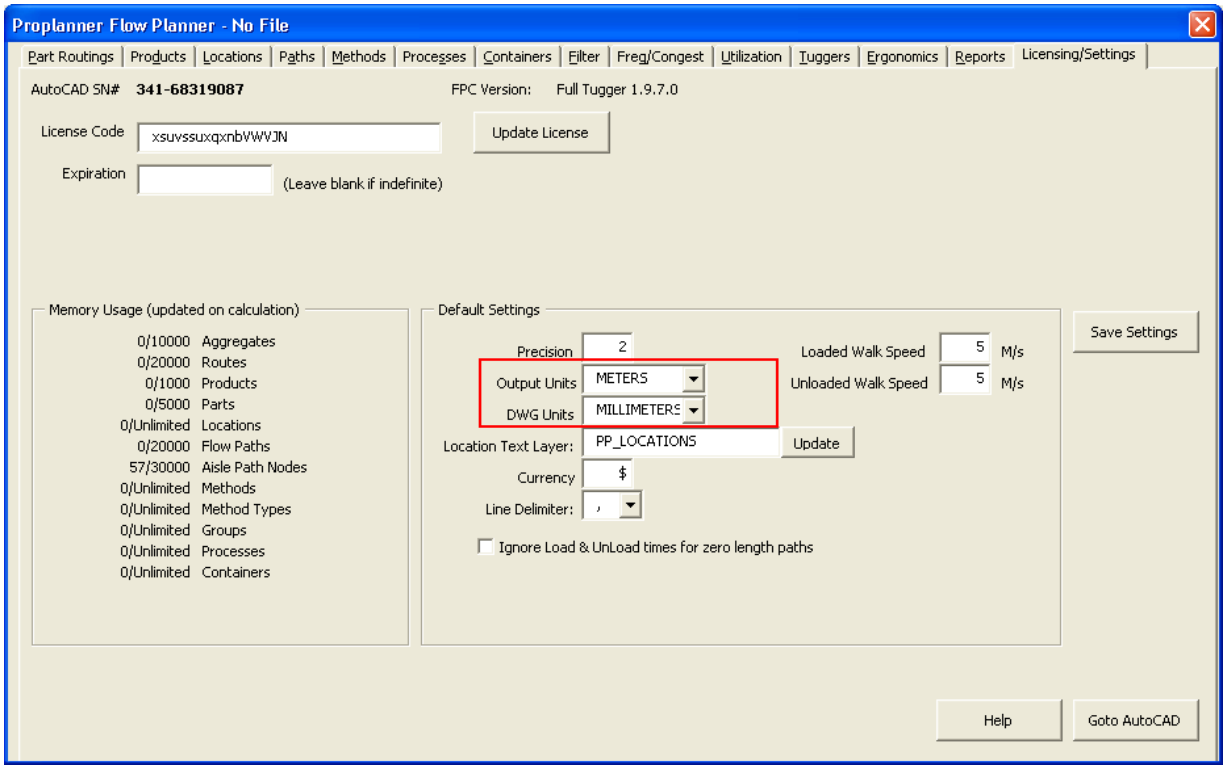
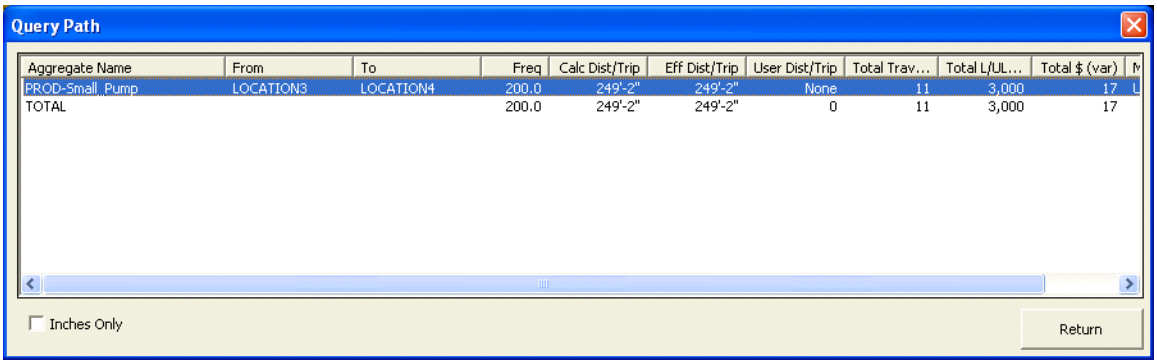


Click on the Go to AutoCAD button and in there click on “QueryPath” on the small modeless window that comes up. Click on the edge of the path connecting Location3 and Location4. Hit enter and the following window is shown.


Query Path
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (var)
PROD-Small_Pump | LOCATION3 | LOCATION4 | 200.0 | 249'-2" | 249'-2" | None | 11 | 3,000 | 17
TOTAL | | | 200.0 | 249'-2" | 249'-2" | 0 | 11 | 3,000 | 17
Inches Only
Return

STEP 5: Products Tab

Click on “Return to Flow Path Calc”.

To change the color of the flow lines for BASEPLATE, go to the “Products” tab

Select “Small_Pump” from the product window on the left which causes the part names to change on the right. Select BASEPLATE in the parts window on the right

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and change color to “2-Yellow” to the left of the update button. Click on the Update button to apply the color.

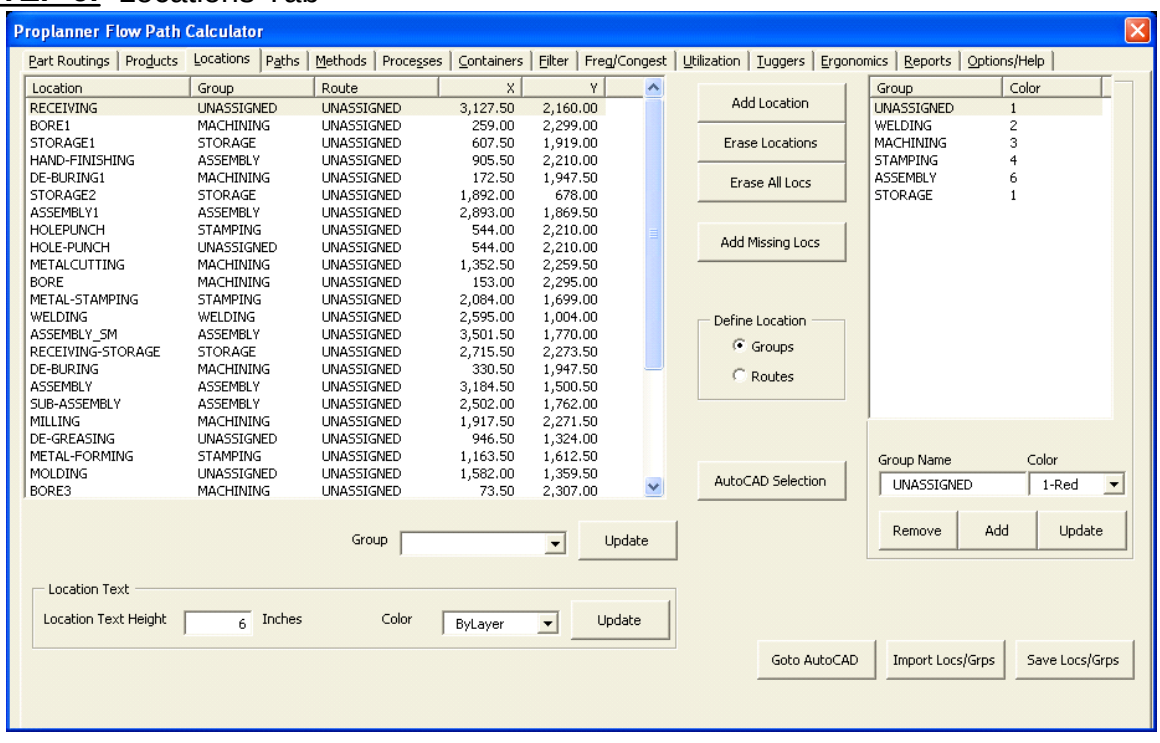
On the Part Routings tab change the “Aggregate by” control, near the calculate button in the bottom right, to “Part” and click calculate.

You will now see that the line that was red is now yellow. This is because the calculations and lines are drawn by part movements not summarily for the product movements.

Return to the FP by clicking on “Return to Flow Path Calc”.

Note: To prepare for the next steps re-run a calculation by “Product”. Next in the Part Routings window, change the from and to locations for the BASEPLATE trip by clicking the that row. Now, update the "From" location - Location 3 to Location 5, and update the "To" location - Location 4 to Location 6. The user can update the information by clicking on the "Update Row" button . Do not do another calculation yet. You will be shown another way to add locations to the drawing.

STEP 6: Locations Tab



Since you just changed the trip to go from “LOCATION3 TO LOCATION4” to “LOCATION5 TO LOCATION6” on the part routings tab, LOCATION5 and LOCATION6 need added to the drawing. This can be done on the Locations tab by selecting “Add Missing Location”.

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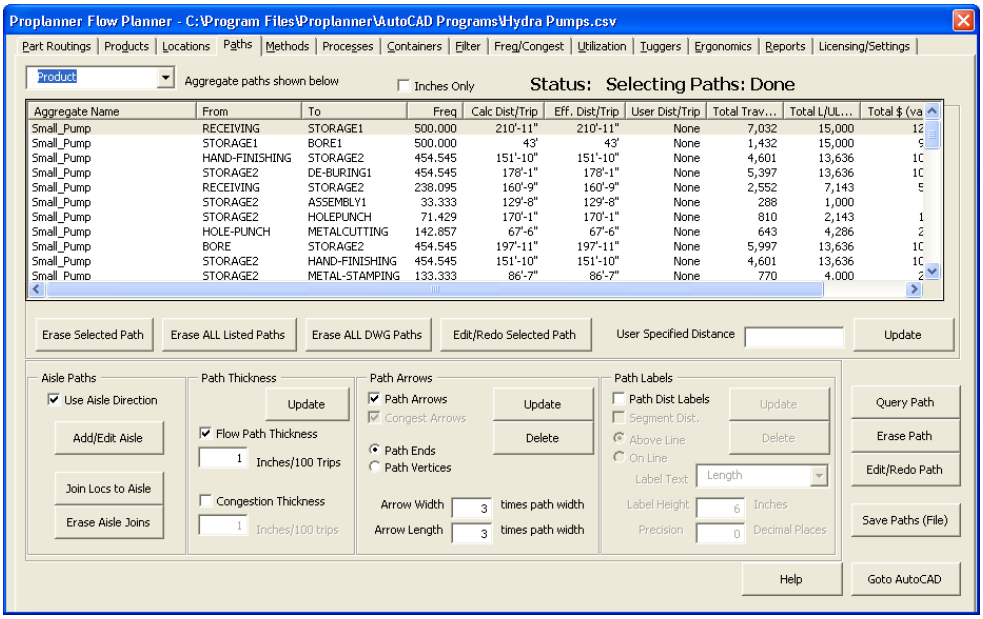
The program now goes to AutoCAD where you can specify where LOCATION5 is, click somewhere near where LOCATION3 was. With LOCATION6, click where LOCATION4 was.

The new locations will show up in the Locations display list. The “Group” of the location will be assigned UNASSIGNED” by default. This part of the exercise was to show that locations can be added here one at a time as well as entering many of them when a calculation is performed on a new drawing.

STEP 7: Paths Tab

Click on the first routing listed on the Paths tab. It should be for product Small Pump going from Receiving to Storage1. Enter “0” in the “User Specified Distance” and select update. The user specified distance overrides the calculated distance


Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.000 | 210'-11" | 210'-11" | None | 7,032 | 15,000 | 12
Small_Pump | STORAGE1 | BORE1 | 500.000 | 43' | 43' | None | 1,432 | 15,000 | 9
Small_Pump | HAND-FINISHING | STORAGE2 | 454.545 | 151'-10" | 151'-10" | None | 4,601 | 13,636 | 10
Small_Pump | STORAGE2 | DE-BURING1 | 454.545 | 178'-1" | 178'-1" | None | 5,397 | 13,636 | 10
Small_Pump | RECEIVING | STORAGE2 | 238.095 | 160'-9" | 160'-9" | None | 2,552 | 7,143 | 5
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.333 | 129'-8" | 129'-8" | None | 288 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.429 | 170'-1" | 170'-1" | None | 810 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.857 | 67'-6" | 67'-6" | None | 643 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.545 | 197'-11" | 197'-11" | None | 5,997 | 13,636 | 10
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 151'-10" | 151'-10" | None | 4,601 | 13,636 | 10
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 86'-7" | 86'-7" | None | 770 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
Inches/100 Trips
Congestion Thickness
Inches/100 trips
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
times path width
Arrow Length
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Label Text
Length
Label Height
Inches
Precision
Decimal Places
Update
Delete
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

The field “User Dist/Trip” changes to zero after updating for the selected path. On Part Routings tab uncheck “Regen All Paths” and calculate. The total distance for Small_Pump reduces by about 43 feet if you run a calculation this way.

Re-check “Regen All Paths” for the rest of this tutorial because user defined distances are not needed in this case.

In “Paths” tab, click on “Add/Edit Aisle” in the lower-left corner of the Paths tab. You will be taken to the AutoCAD drawing with the Aisle Add/Edit window.

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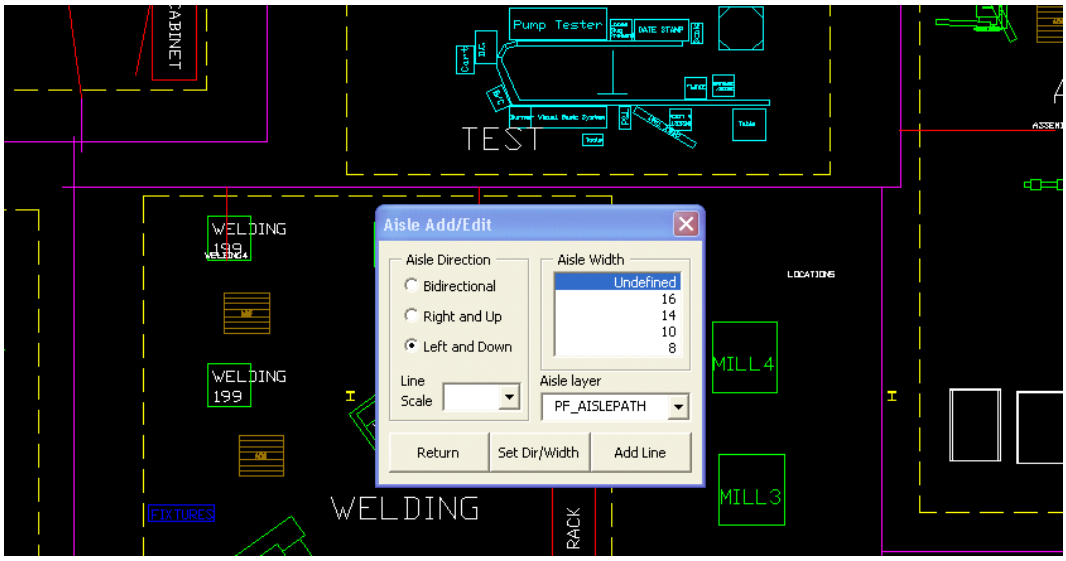
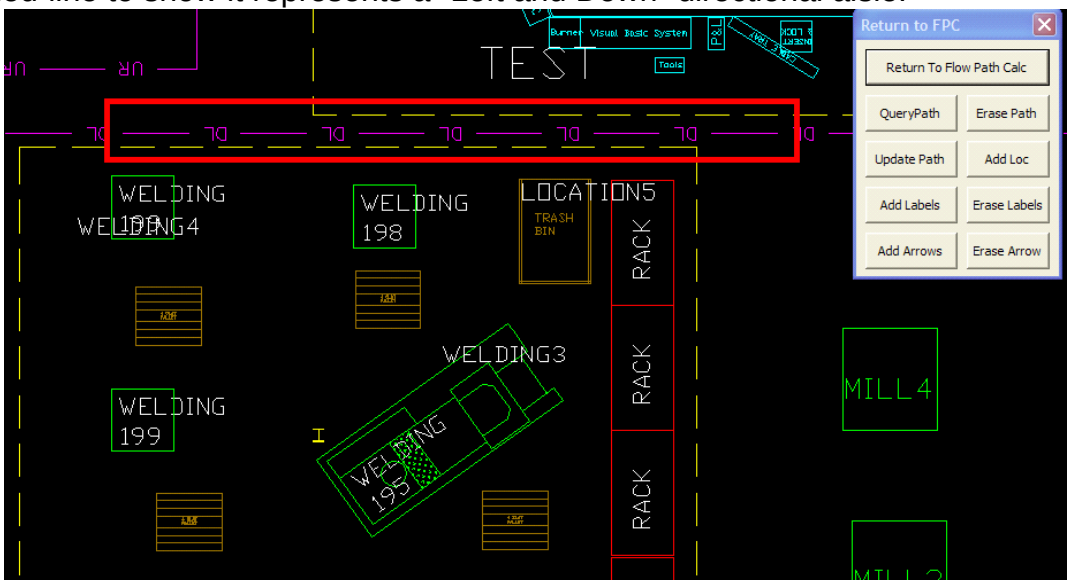


Set the aisle direction to "Left and Down" as shown in the image and press "Set Dir/Width". Click on the aisle above "LOCATION5". The solid line changes to a dashed-line to show it represents a “Left and Down” directional aisle.



Similarly, set “Down and Left” direction to 2 other paths as shown here in red. [NOTE: Red rectangles will not appear in the drawing.]

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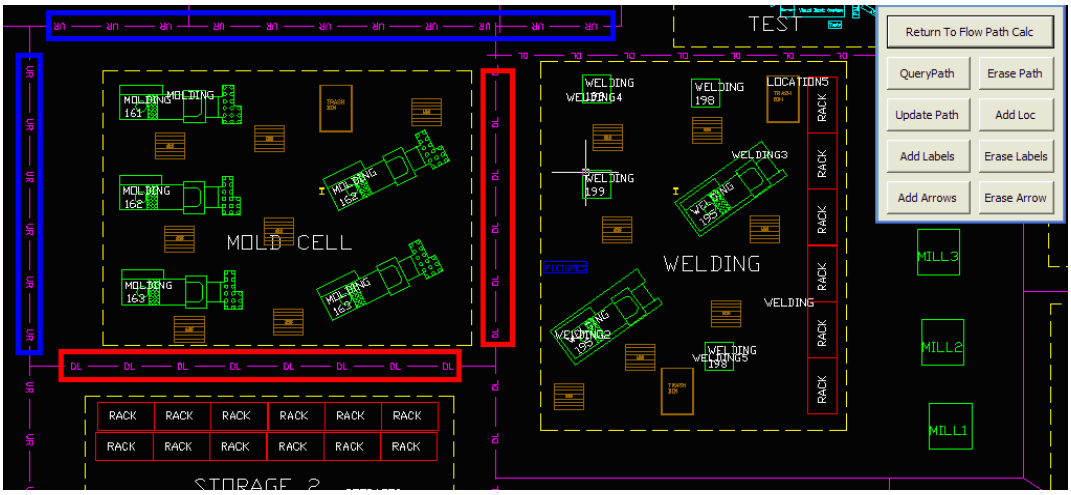
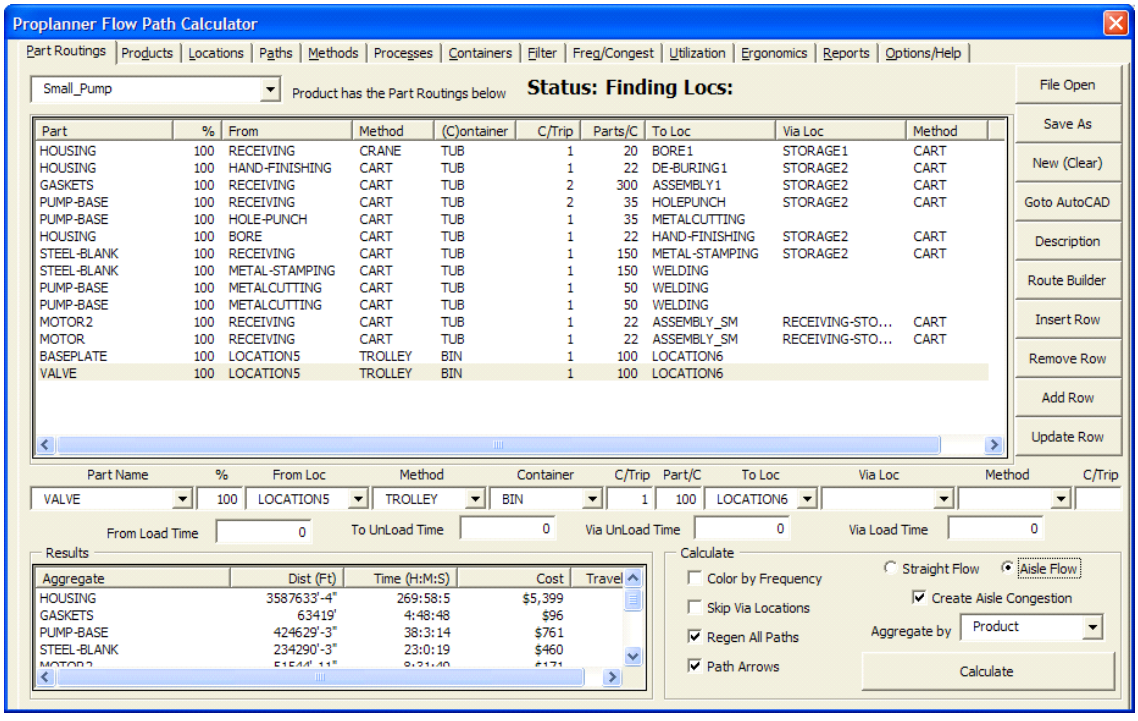


Next Set “Up and Right” direction to the two aisle paths boxed in blue in the drawing.

Click “Return”. You will be taken back to the Paths tab.

Click on “Join Locs to Aisle”. A message says “All Locations now joined to Paths”.

Go to Part Routings tab, check the “Aisle Flow” option as shown and click Calculate. This shows routings over the aisle paths which follow the shortest path allowable between two points. This also takes into account one way aisles, if they exist. Click on Return to Flow Path Calc once the aisle flow lines are drawn.


Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Small_Pump
Product has the Part Routings below
Status: Finding Locs:
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Route Builder
Insert Row
Remove Row
Add Row
Update Row
Part | % | From | Method | (C)ontainer | C/Trip | Parts/C | To Loc | Via Loc | Method
HOUSING 100 RECEIVING CRANE TUB 1 20 BORE1 STORAGE1 CART
HOUSING 100 HAND-FINISHING CART TUB 1 22 DE-BURING1 STORAGE2 CART
GASKETS 100 RECEIVING CART TUB 2 300 ASSEMBLY1 STORAGE2 CART
PUMP-BASE 100 RECEIVING CART TUB 2 35 HOLEPUNCH STORAGE2 CART
PUMP-BASE 100 HOLE-PUNCH CART TUB 1 35 METALCUTTING
HOUSING 100 BORE CART TUB 1 22 HAND-FINISHING STORAGE2 CART
STEEL-BLANK 100 RECEIVING CART TUB 1 150 METAL-STAMPING STORAGE2 CART
STEEL-BLANK 100 METAL-STAMPING CART TUB 1 150 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
MOTOR2 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
MOTOR 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
BASEPLATE 100 LOCATION5 TROLLEY BIN 1 100 LOCATION6
VALVE 100 LOCATION5 TROLLEY BIN 1 100 LOCATION6
Part Name | % | From Loc | Method | Container | C/Trip | Part/C | To Loc | Via Loc | Method | C/Trip
VALVE 100 LOCATION5 TROLLEY BIN 1 100 LOCATION6
From Load Time 0
To UnLoad Time 0
Via UnLoad Time 0
Via Load Time 0
Results
Aggregate | Dist (Ft) | Time (H:M:S) | Cost | Travel
HOUSING 3587633'-4" 269:58:5 $5,399
GASKETS 63419' 4:48:48 $96
PUMP-BASE 424629'-3" 38:3:14 $761
STEEL-BLANK 234290'-3" 23:0:19 $460
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by Product
Calculate

Step 8:

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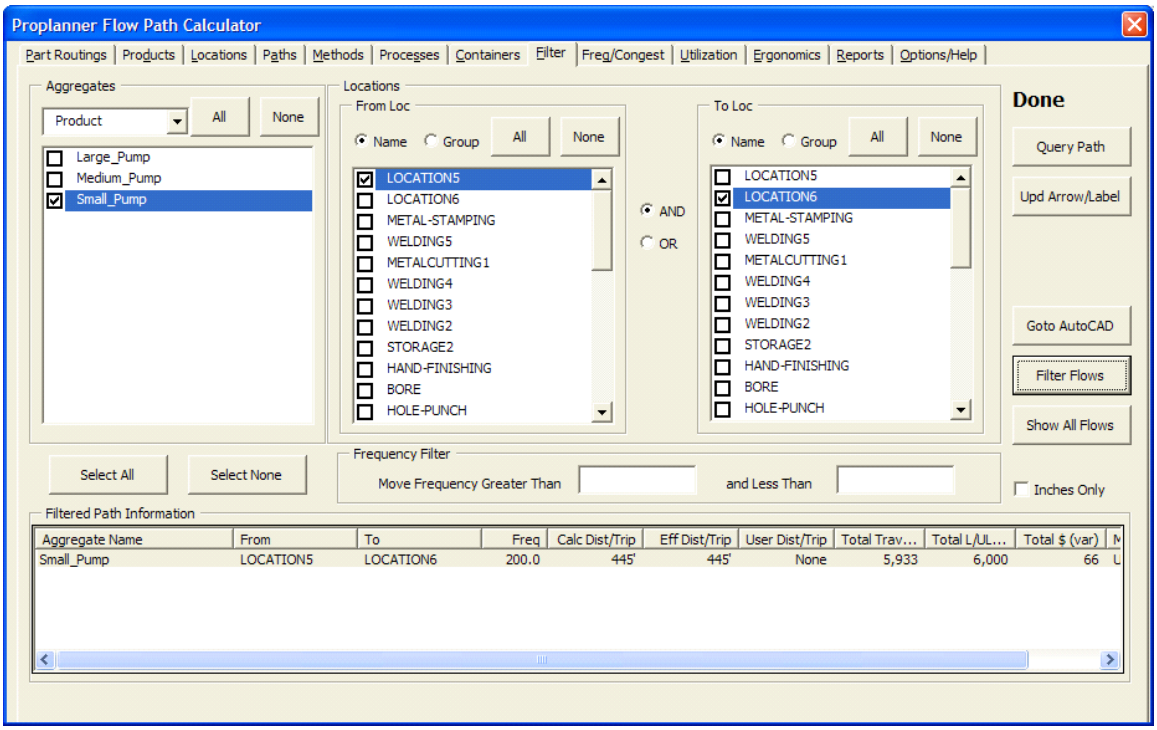
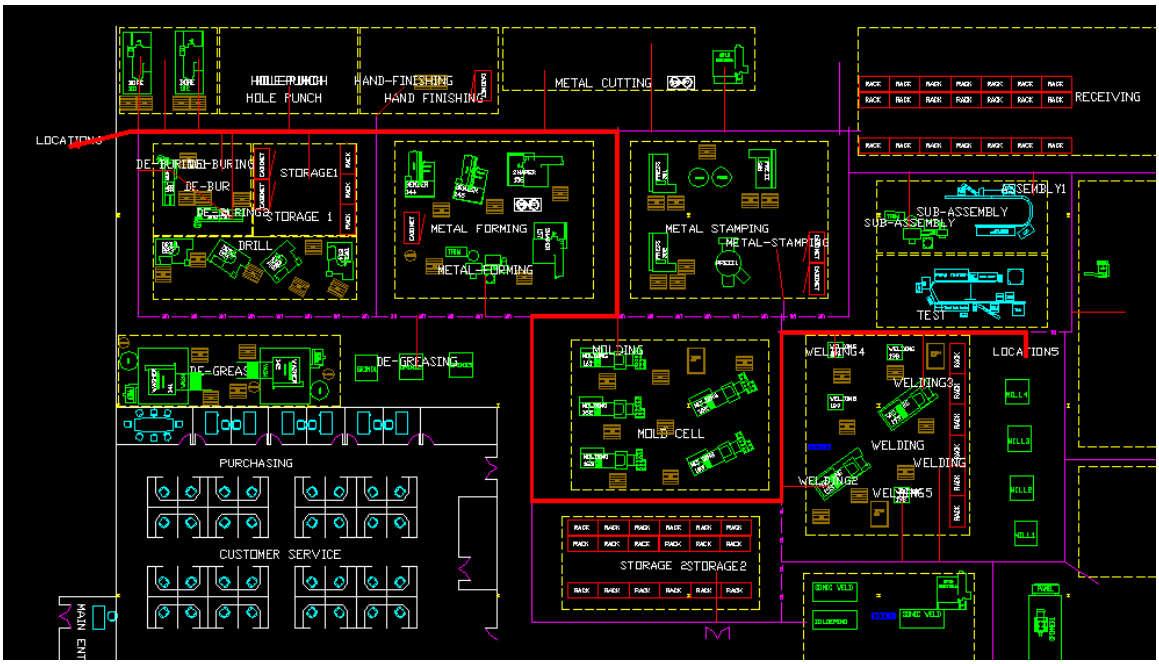
Go to Filter Tab. Click the Product as shown below and select LOCATION5 and LOCATION6 as the from and to locations.



Click “Filter Flows”. The AutoCAD drawing shows the path taken from LOCATION5 to LOCATION6 as shown in the image. It does not take a shorter path as the shorter path is given a “Right and Up” direction.



Step 9: Congestion Tab

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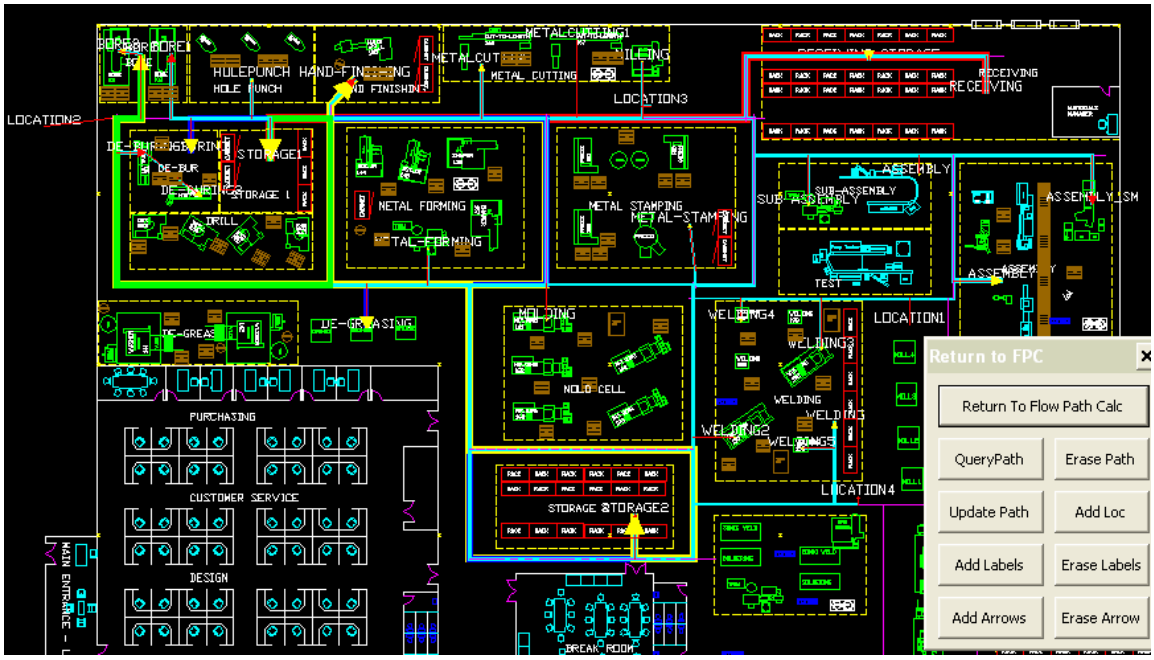
Go to the "Part Routings" tab. Change “Aggregate by” to "Method Type" and check the "Color by Frequency" option. Press "Calculate".



The drawing shows the colors according to settings on the "Freq/Congestion" tab. The "Frequency Color Scale" shows that the path colors are.

0 - 50%	- Cyan
51 - 70%	- Blue
71 - 85%	- Green
85 - 95%	- Yellow
96 - 100%	- Red

The percentages are based upon the highest frequency of flow. Therefore, the red lines will be those with flow frequencies between 95% and 100% of the highest frequency flow in the study.

To see a Congestion diagram that demonstrates where the largest amount of plant wide flow is, change the aggregate name on the "Congestion Tab" to congestion and select update.

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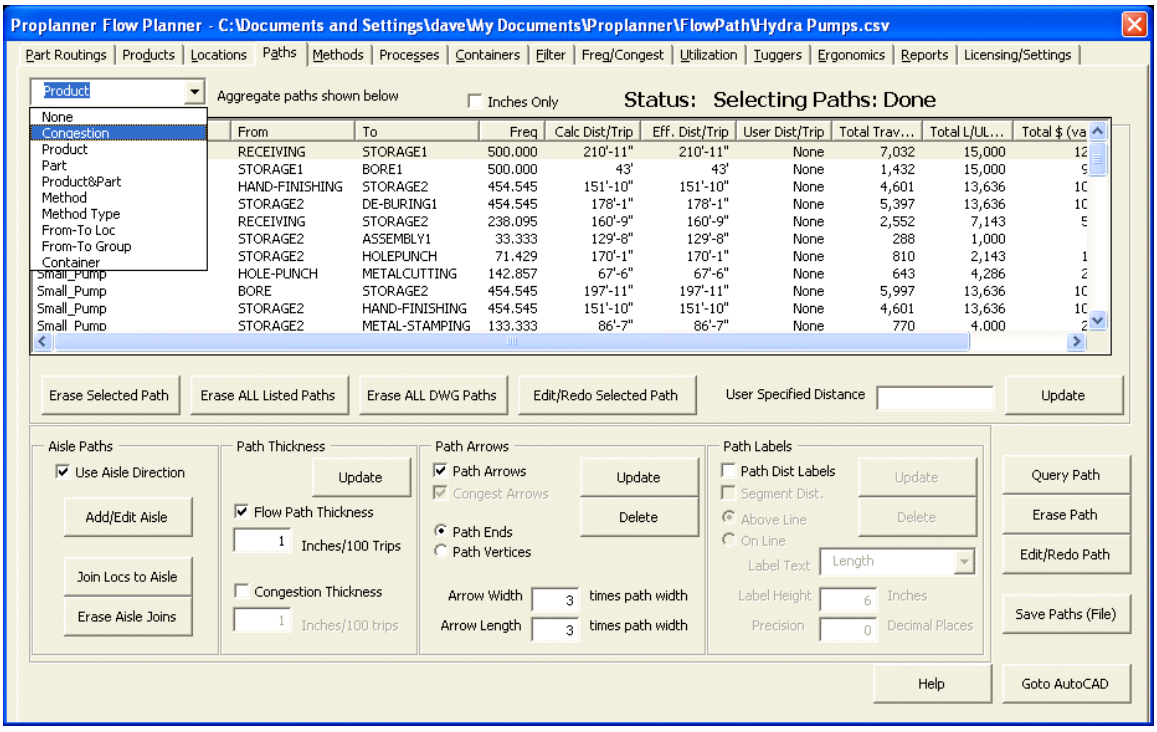
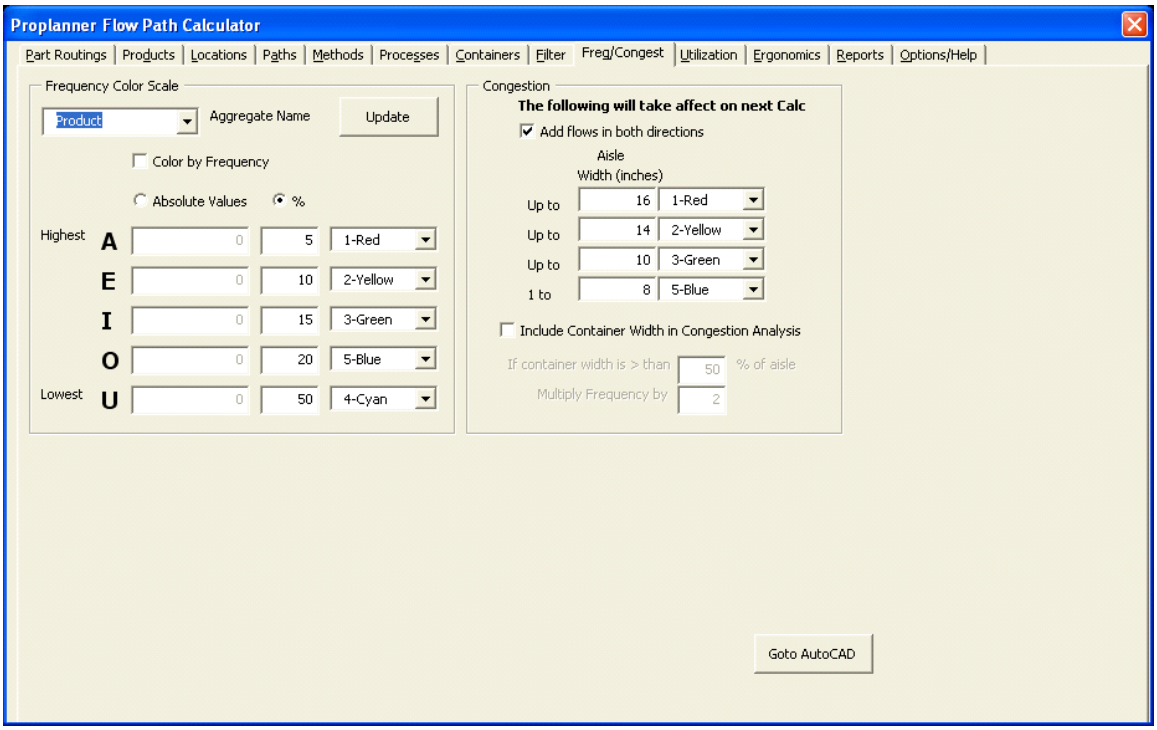

Proplanner Flow Planner - C:\Documents and Settings\dave\My Documents\Proplanner\FlowPath\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
None
Congestion
Product
Part
Product&Part
Method
Method Type
From-To Loc
From-To Group
Container
From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
RECEIVING | STORAGE1 | 500.000 | 210'-11" | 210'-11" | None | 7,032 | 15,000
STORAGE1 | BORE1 | 500.000 | 43' | 43' | None | 1,432 | 15,000
HAND-FINISHING | STORAGE2 | 454.545 | 151'-10" | 151'-10" | None | 4,601 | 13,636
STORAGE2 | DE-BURING1 | 454.545 | 178'-1" | 178'-1" | None | 5,397 | 13,636
RECEIVING | STORAGE2 | 238.095 | 160'-9" | 160'-9" | None | 2,552 | 7,143
STORAGE2 | ASSEMBLY1 | 33.333 | 129'-8" | 129'-8" | None | 288 | 1,000
STORAGE2 | HOLEPUNCH | 71.429 | 170'-1" | 170'-1" | None | 810 | 2,143
HOLE-PUNCH | METALCUTTING | 142.857 | 67'-6" | 67'-6" | None | 643 | 4,286
Small_Pump | BORE | STORAGE2 | 454.545 | 197'-11" | 197'-11" | None | 5,997 | 13,636
Small_Pump | STORAGE2 | HAND-FINISHING | 454.545 | 151'-10" | 151'-10" | None | 4,601 | 13,636
Small_Pump | STORAGE2 | METAL-STAMPING | 133.333 | 86'-7" | 86'-7" | None | 770 | 4,000
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
1
Inches/100 Trips
Congestion Thickness
1
Inches/100 trips
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
3
times path width
Arrow Length
3
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
6
Inches
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Save Paths (File)
Help
Goto AutoCAD

This will show information based on the calculation you have already done and sum travel over each segment of the aisle path network. When done, a diagram of where transportation bottlenecks may occur is provided.



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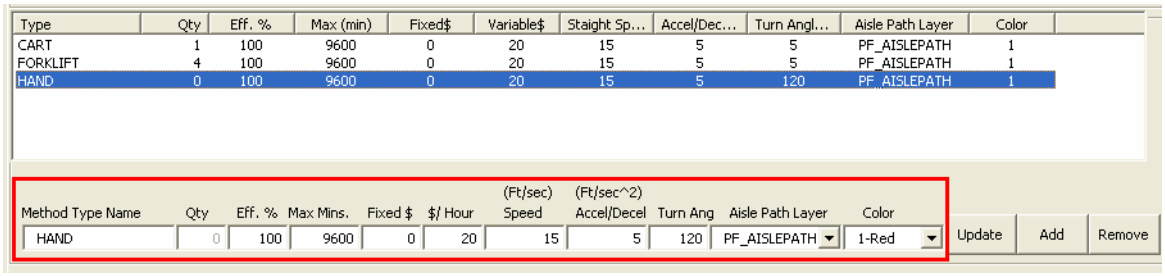
STEP 10: Go to Methods Tab.

(These are added automatically from the routing information or can be added manually)

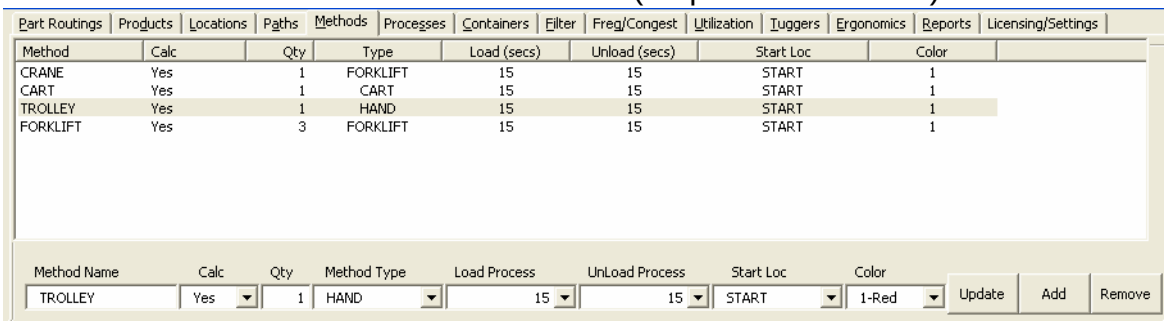
You can add a new “Method Type” by adding new values in the “Method Types” control in the lower half of the window, as shown in the following:


Type Qty Eff. % Max (min) Fixed$ Variable$ Staight Sp... Accel/Dec... Turn Angl... Aisle Path Layer Color
CART 1 100 9600 0 20 15 5 5 PF_AISLEPATH 1
FORKLIFT 4 100 9600 0 20 15 5 5 PF_AISLEPATH 1
HAND 0 100 9600 0 20 15 5 120 PF_AISLEPATH 1
Method Type Name Qty Eff. % Max Mins. Fixed $ $/ Hour (Ft/sec) Speed (Ft/sec^2) Accel/Decel Turn Ang Aisle Path Layer Color
HAND 0 100 9600 0 20 15 5 120 PF_AISLEPATH 1-Red
Update Add Remove

The user can add a new method type or use an existing one for this tutorial.

Next, we can add a “Material Handling Method”. In the upper half of the window, give the following values to the “Material Handling Methods” parameters.

Method Name	= “TROLLEY2”
Calc	= “Yes” (drop-down selection)
Qty	= “1”
Method Type	= “HAND” (drop-down selection)
Load Process	= “5” (drop-down selection)
UnLoad Process	= “5” (drop-down selection)
Start Loc	= “RECEIVING” (drop-down selection)
Color	= “3” (drop-down selection)


Part Routings Products Locations Paths Methods Processes Containers Filter Freq/Congest Utilization Tuggers Ergonomics Reports Licensing/Settings
Method Calc Qty Type Load (secs) Unload (secs) Start Loc Color
CRANE Yes 1 FORKLIFT 15 15 START 1
CART Yes 1 CART 15 15 START 1
TROLLEY Yes 1 HAND 15 15 START 1
FORKLIFT Yes 3 FORKLIFT 15 15 START 1
Method Name Calc Qty Method Type Load Process UnLoad Process Start Loc Color
TROLLEY Yes 1 HAND 15 15 START 1-Red
Update Add Remove

Click on the “Add” button after entering the values. This row adds to the 3 methods already present.

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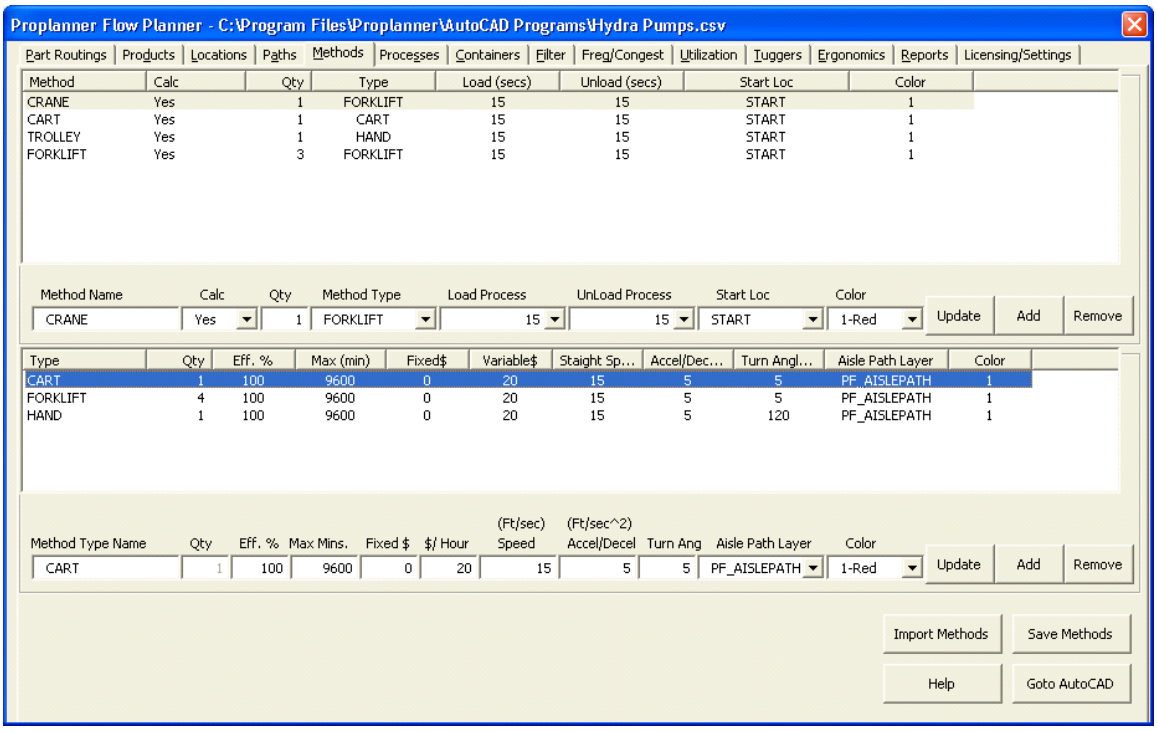
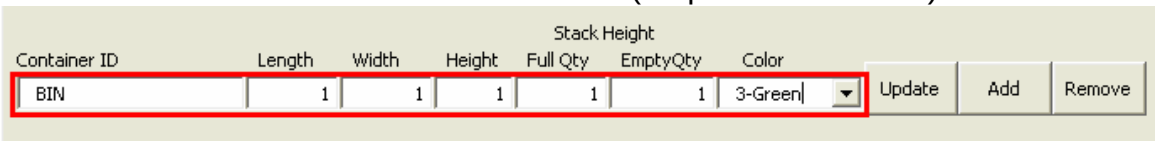

Proplanner Flow Planner - C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.csv
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Method | Calc | Qty | Type | Load (secs) | Unload (secs) | Start Loc | Color
CRANE | Yes | 1 | FORKLIFT | 15 | 15 | START | 1
CART | Yes | 1 | CART | 15 | 15 | START | 1
TROLLEY | Yes | 1 | HAND | 15 | 15 | START | 1
FORKLIFT | Yes | 3 | FORKLIFT | 15 | 15 | START | 1
Method Name | Calc | Qty | Method Type | Load Process | UnLoad Process | Start Loc | Color
CRANE | Yes | 1 | FORKLIFT | 15 | 15 | START | 1-Red
Update | Add | Remove
Type | Qty | Eff. % | Max (min) | Fixed$ | Variable$ | Staight Sp... | Accel/Dec... | Turn Angl... | Aisle Path Layer | Color
CART | 1 | 100 | 9600 | 0 | 20 | 15 | 5 | 5 | PF_AISLEPATH | 1
FORKLIFT | 4 | 100 | 9600 | 0 | 20 | 15 | 5 | 5 | PF_AISLEPATH | 1
HAND | 1 | 100 | 9600 | 0 | 20 | 15 | 5 | 120 | PF_AISLEPATH | 1
Method Type Name | Qty | Eff. % | Max Mins. | Fixed $ | $/ Hour | (Ft/sec) Speed | (Ft/sec^2) Accel/Decel | Turn Ang | Aisle Path Layer | Color
CART | 1 | 100 | 9600 | 0 | 20 | 15 | 5 | 5 | PF_AISLEPATH | 1-Red
Update | Add | Remove
Import Methods | Save Methods
Help | Goto AutoCAD

STEP 11: Go to Containers Tab. (Also added automatically from the routing information or manually on this tab) Give the following values to the "Containers" parameters.

Container ID = "BIN2"
Length = "1"
Width = "1"
Height = "1"
Full Qty = "1"
EmptyQty = "1"
Color = "3-Green" (drop-down selection)



Click on the "Add" button to add this new Container

STEP 12: Reports
Next go to the Reports tab. Notice that Method Type should already be selected as your aggregate type in "Part Routings" tab and "Calculate" should already be hit, because it was the last calculation type performed. Select all Fields to Print and set the report type to All Flow Paths.

Clicking the Create Report button now will create a XML based report including all the path information in a well organized, easy to read web format.

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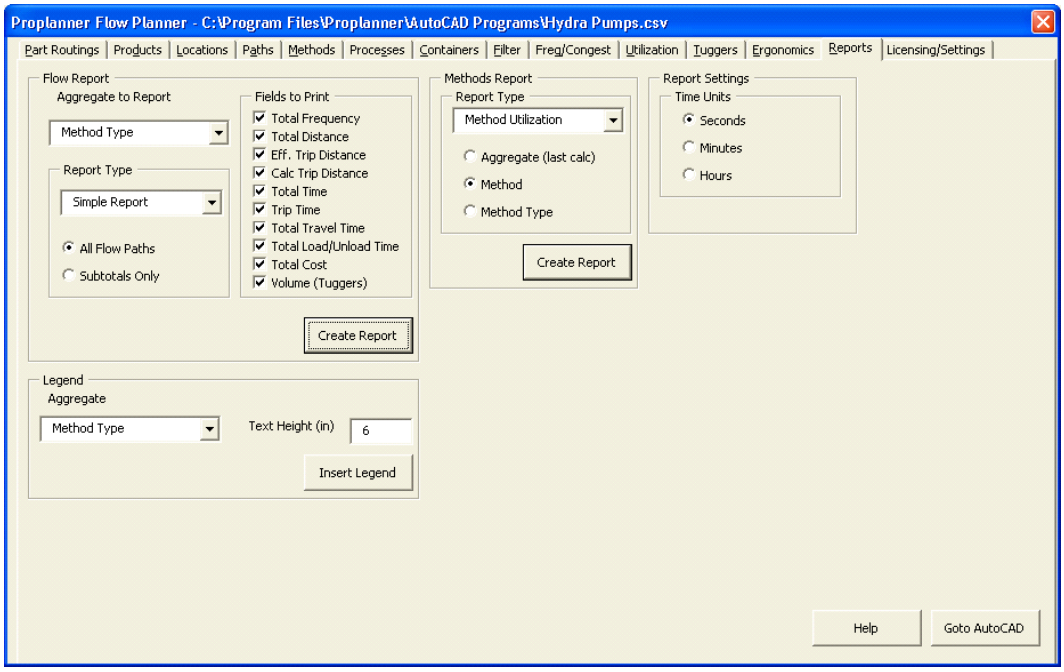
If the time units, report type, or fields are selected differently than displayed in a previous report, creating a new report will automatically display data according to the new settings.

A Material Handling Device report by method, method type, or the last aggregation can be created here also. This is produced in the same manner as the Flow Report and shows the Methods output specifically for Aggregate, method, or method type.



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6.2 Tugger add-on Tutorial

This tutorial applies only to the Tugger Add-on that can be optionally purchased with the full version of the Flow Planner application. The Tugger analysis module provides you with the ability to quickly and easily evaluate the many prospective benefits of material delivery using tow-train tuggers that pull multiple carts of material along prescribed routes through the factory. With this module, you need only specify what materials that you wish to deliver and when you would like those deliveries to happen and then sit back and watch the Tugger route generator do the rest.

Preparing the Data

When starting from new, you will need to either create, or import, your delivery information into a spreadsheet in the format shown below. Once the fields are filled with their respective data, (described in the Tuggers section of the Flow Planner manual), this file will be ready to import into the Flow Planner Tugger module.

A1 *ID

	A	B	C	D	E	F	G	H	I	J	K	L
1	*ID	Part	Container	ContQty	From	Stage	To	ETD	Direction	Load	Unload	
2	1	111456	BOX35	1	REC_2	STAGE	HOLEPUNCH	7.1	1			
3	2	111847	BOX36	1	REC_3	STAGE	DE-BURING	UFM(7/10/2/.5)	1			
4	3	111332	CRATE2	1	REC_4	STAGE	BORE	7.3	-1			
5	4	111445	CRATE2	1	REC_5	STAGE	DE-BURING1	UFM(7/10/1/1)	-1			
6	5	235448	FLAT	2	REC_14	STAGE	DE-GREASING	7.5	1	15	10	
7	6	235449	FLAT	1	REC_15	STAGE	METAL-FORMING	7.6	1			
8	7	235450	FLAT	1	REC_16	STAGE	METAL-STAMPING	7.7	1			
9	8	111456	BOX35	1	REC_17	STAGE	HOLEPUNCH	8.2	1			
10	9	111847	BOX36	2	REC_10	STAGE	DE-BURING	8.1	1			
11	10	111332	CRATE2	1	REC_11	STAGE	BORE	8.7	1			
12	11	111445	CRATE2	1	REC_12	STAGE	DE-BURING1	8	1			
13	12	235448	FLAT	1	REC_13	STAGE	DE-GREASING	8.8	-1			
14	13	235449	FLAT	2	REC_30	STAGE	METAL-FORMING	8.9	1			
15	14	235450	FLAT	1	REC_31	STAGE	METAL-STAMPING	8.7	1			
16	15	235988	FLAT	1	REC_32	STAGE	METALCUTTING	8.7	-1			
17	16	235989	FLAT	1	REC_17	STAGE	HAND-FINISHING	8.5	1			
18	17	851001	CRATE2	1	REC_18	STAGE	WELDING	8.3	1			
19	18	851002	CRATE3	1	REC_19	STAGE	WELDING3	8.6	-1			
20	19	851003	CRATE4	1	REC_20	STAGE	WELDING4	7.3	1			
21	20	851004	CRATE5	1	REC_21	STAGE	SUB-ASSEMBLY	8.5	1			
22	21	851005	FLAT	1	REC_14	STAGE	ASSEMBLY1	8.3	1			

This is an example of the route file which is saved in a .CSV format.
This file contains the part movements, pick/drop information, and delivery times.

For this example you will use a pre-created set of input files, supplied with the software installation. These files can be found in the directory where the program is installed (most commonly “C:\Program Files\Proplanner\AutoCAD Programs”). There is a back-up set of these tutorial files within the PPFP_Exercise_Samples directory under the Help directory on your CD.

This analysis is set up to analyze a material handling person starting at a STAGE location and then leaving to pick up containers in a receiving area to fill their tugger's carts (in the shortest path order). This person then returns to the STAGE location

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and drives out to the shop floor to deliver those containers (in the shortest path order). When completed, this person will return to the STAGE location. If you intended to only analyze deliveries to the shop floor, or instead the filling of tugger carts in the receiving area, then you could leave the FROM or TO columns blank, respectively.

This analysis has the Estimated Times of Delivery (ETD) specified as decimal hour values (from 0 to 24), with the exception of 2 containers whereby the ETD is statistically determined as any time between 7am and 10am. The 2nd container in this file (row 3) also specifies that 2 container deliveries (individually) must be performed and each of them has a 50% probability of being delivered (UFM/7/10/2/0.5). The 4th container (row 5) specifies that 1 delivery will be scheduled with a 100% probability of happening.

The 4th column (ContQty) specifies how many containers will be delivered per scheduled delivery. Most of the time this column will have a value of 1, as containers are often delivered to the line individually (as opposed to in lots of 2, 3, 4, etc).

The Direction column in this file specifies if containers are LOADED in the FROM location and UNLOADED in the TO location (default value = 1), or if the containers are UNLOADED at the FROM location and LOADED at the TO location (value = -1) as is often done when picking up empty containers. As such, the value in this column is either 1 or -1.

Finally, the LOAD and UNLOAD columns allow you to override the handling time set to the TUG device and instead use the times specified in this delivery file. Only one container (row 6) has its LOAD and UNLOAD time specified.

Note: For a more detailed explanation of the inputs and data definitions, please reference the Tuggers Window section of the Flow Planner manual.

Step 1. To begin with, open the drawing Hydra Pumps.dwg found at "C:\Program Files\Proplanner\AutoCAD Programs"

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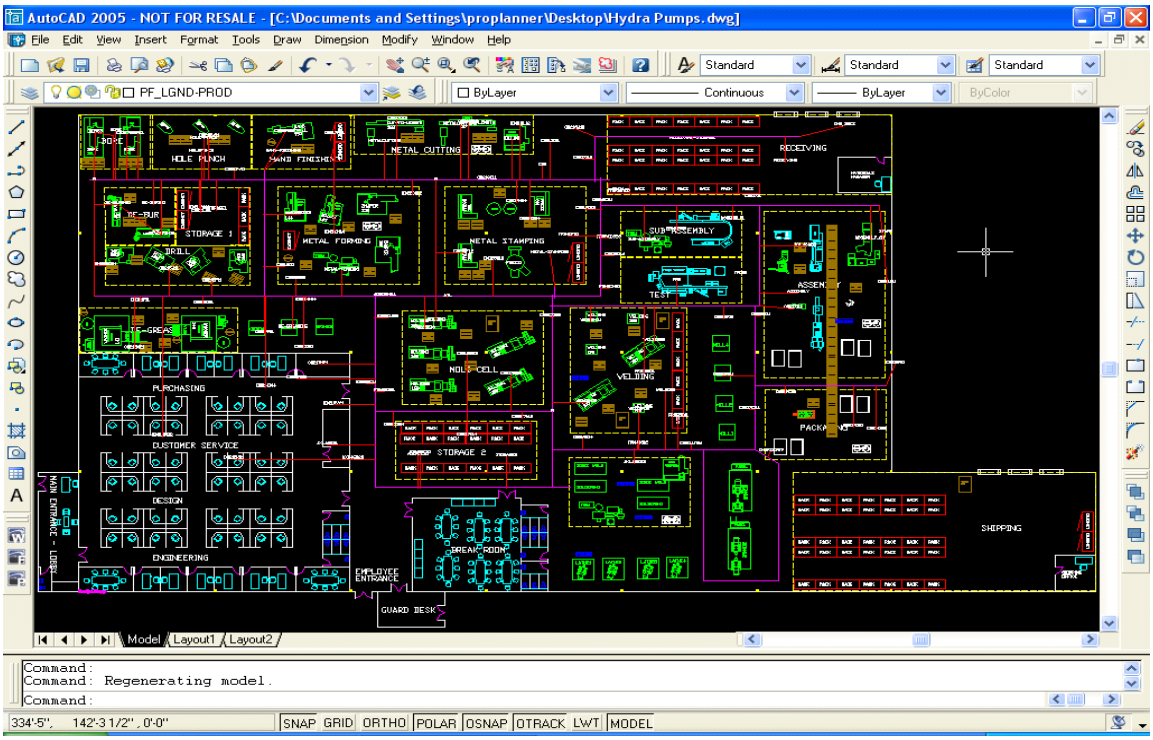
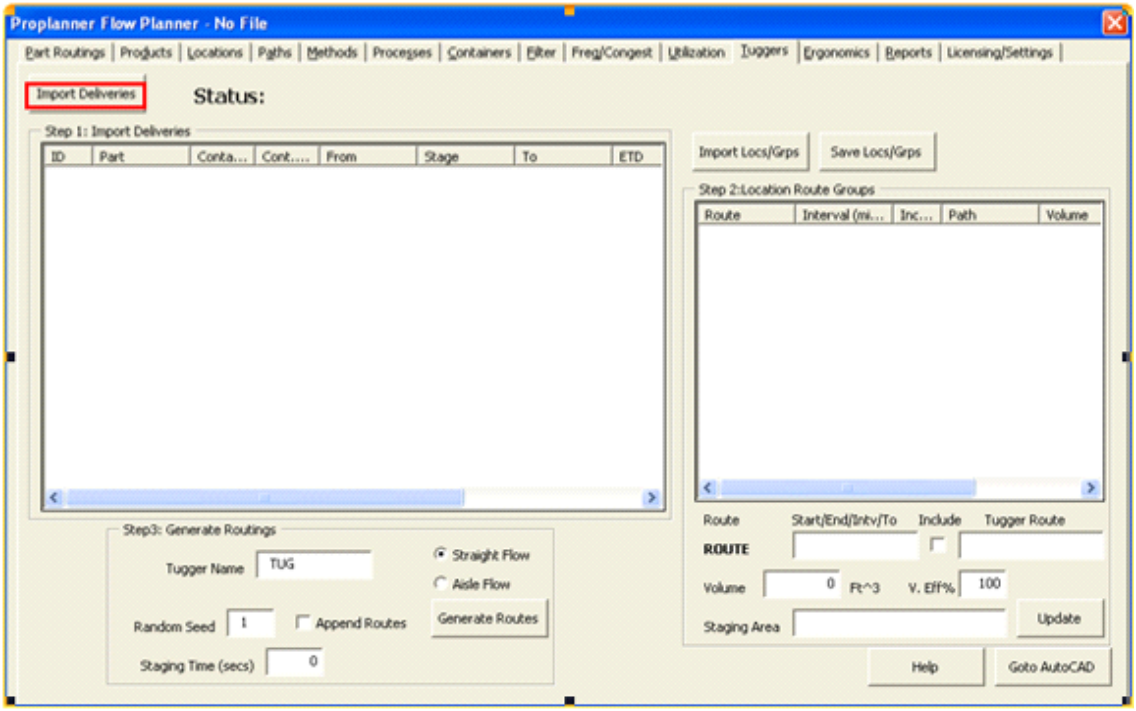


Step 2. Next open the Flow Planner and go to the Tuggers Tab (seen below). Select "Import Deliveries" as highlighted in red below, to open the delivery information files.



A window like the one below will come up prompting the user to select the delivery

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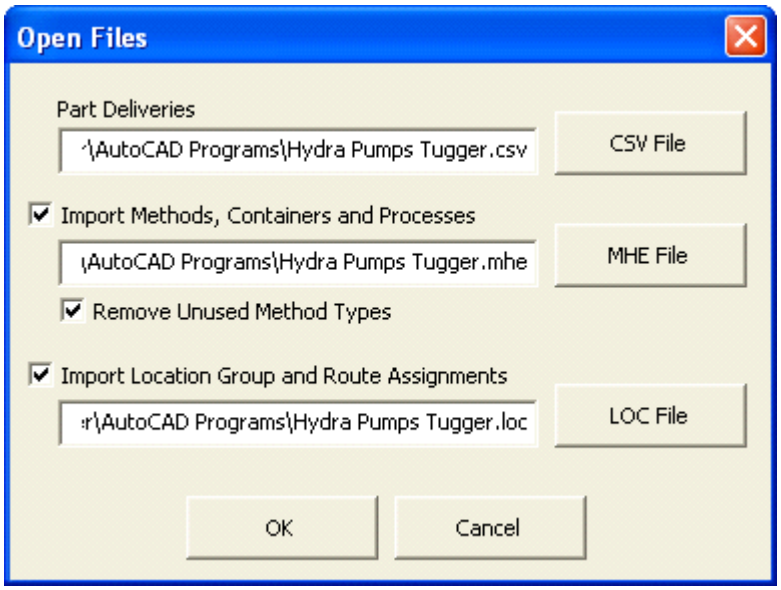
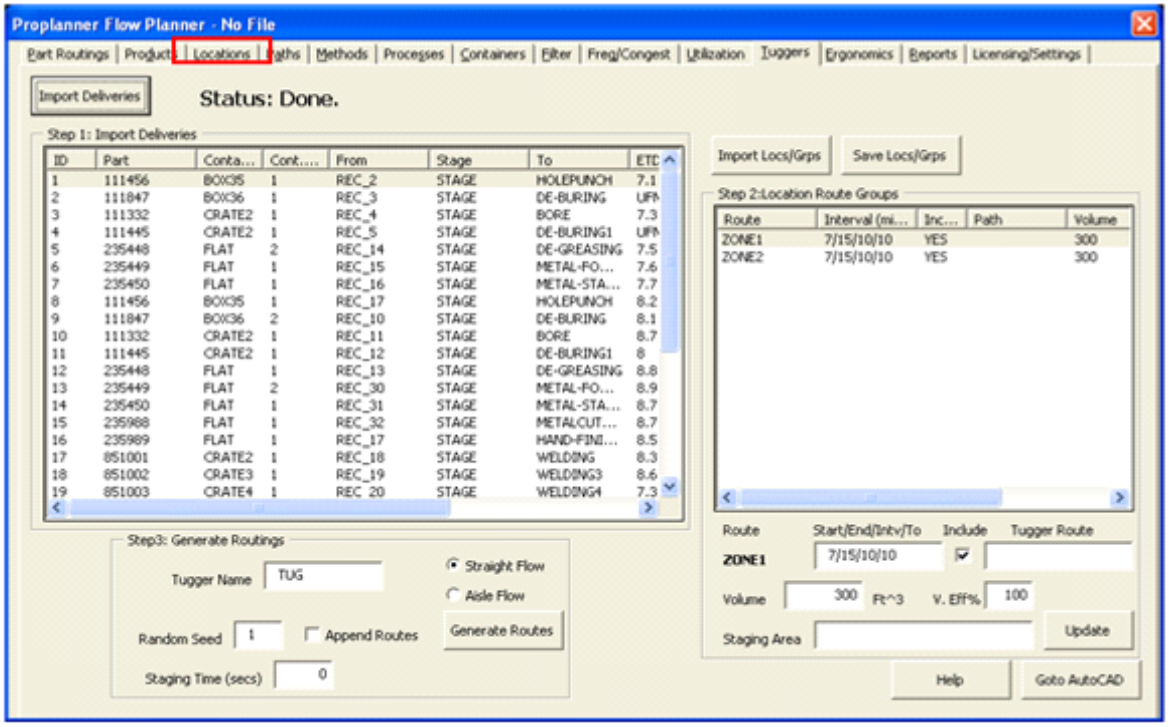
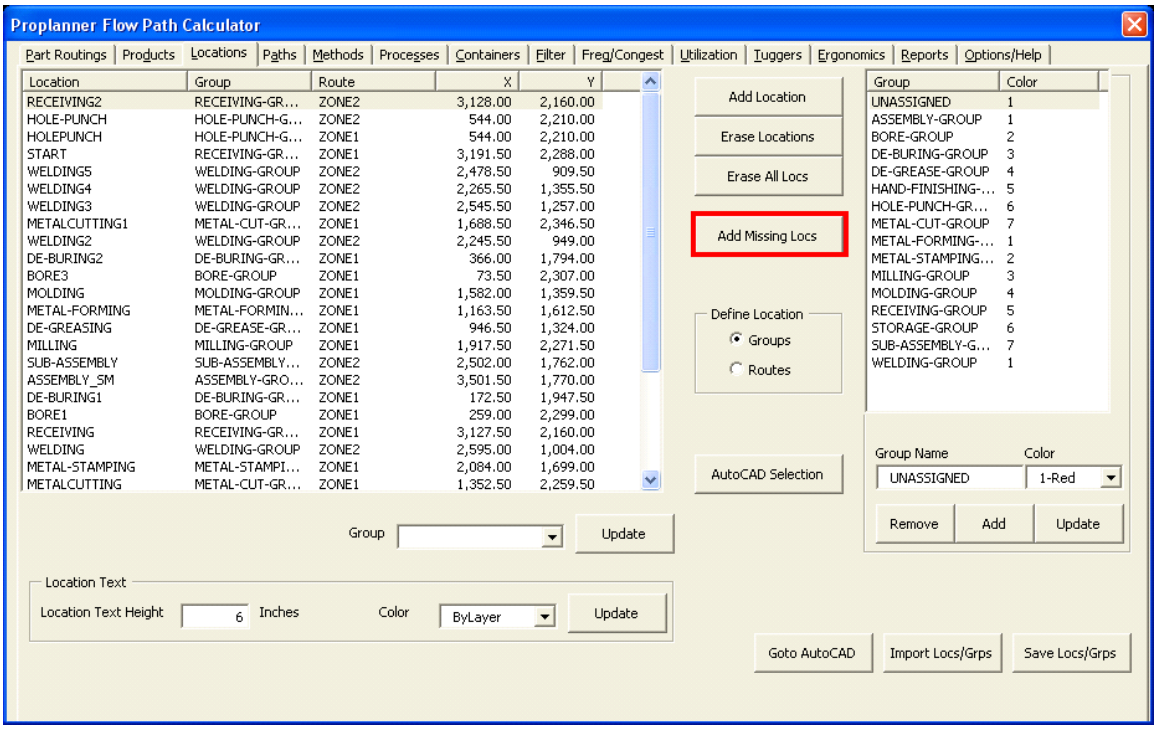
files to be imported. If you select the CSV file button and find "Hydra Pumps Tugger.csv" from the folder where the program is installed to, the rest of the fields will populate.



Step 3. At this point you can check to see delivery and location route group information has been imported correctly and then go to the Locations tab to ensure that coordinates are tied to each location referenced in the delivery information.



Step 4. By clicking "Add Missing Locs" the program will ensure that locations are tied to the coordinates or the user will be prompted to place missing locations onto the drawing. Notice that the ROUTE column in the Locations list box has a value of either ZONE1 or ZONE2. This determines which tugger route driver services that particular location (i.e. like which houses are on a mailman's delivery route). These assignments (i.e. location to route) can be done via the list box, or they can also be done graphically, by windowing a set of locations in the AutoCAD drawing and assigning them to a particular route driver (i.e. ZONE1 or ZONE2 in this tutorial).



Step 5. Now select the Methods Tab to view the material handling device information. Each route driver has its own LOAD and UNLOAD time data. You can see in this example, that the LOAD time is 15 seconds for both drivers (ZONE 1 and ZONE2) and is set to a Process name of UNLOAD for the ZONE1 driver's UNLOAD time and 15 seconds for ZONE2 driver's UNLOAD time. You can view the Process information for the UNLOAD task in the Process tab. Both driver's use a Method Type (device) of TUG and this device is set to have a speed of 5 feet/second.

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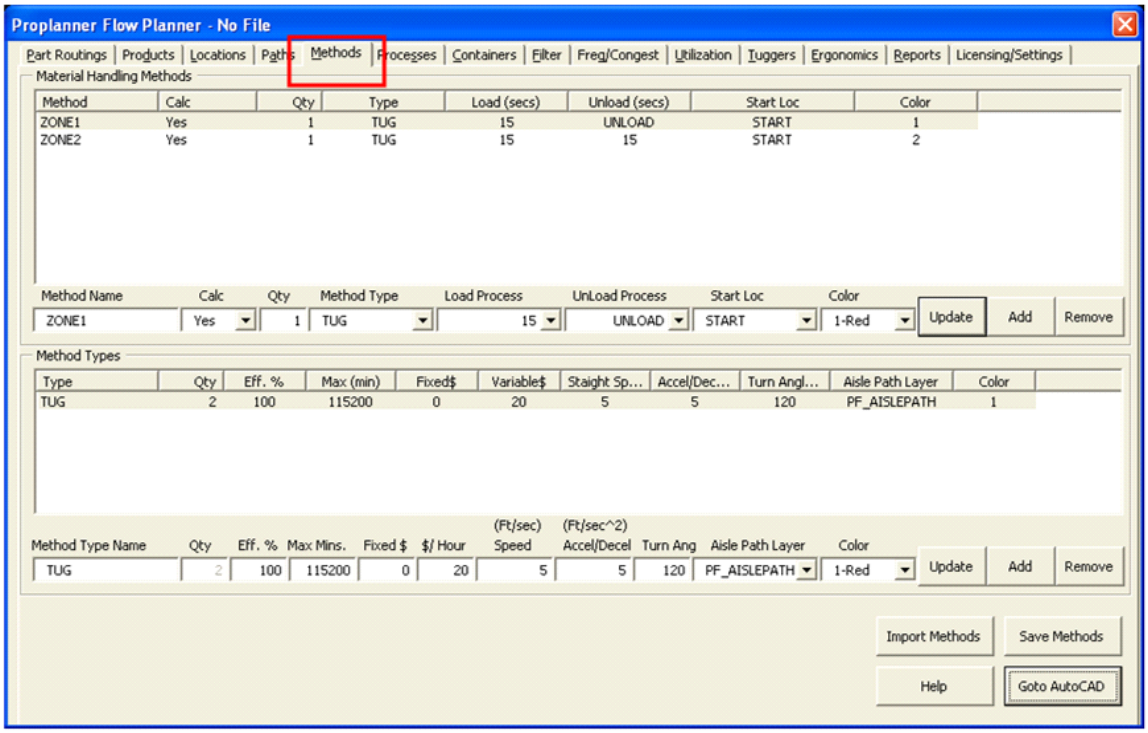
Proplanner Flow Planner - No File
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Material Handling Methods
Method Calc Qty Type Load (secs) Unload (secs) Start Loc Color
ZONE1 Yes 1 TUG 15 UNLOAD START 1
ZONE2 Yes 1 TUG 15 15 START 2
Method Name Calc Qty Method Type Load Process UnLoad Process Start Loc Color
ZONE1 Yes 1 TUG 15 UNLOAD START 1-Red
Update Add Remove
Method Types
Type Qty Eff. % Max (min) Fixed$ Variable$ Staight Sp... Accel/Dec... Turn Angl... Aisle Path Layer Color
TUG 2 100 115200 0 20 5 5 120 PF_AISLEPATH 1
Method Type Name Qty Eff. % Max Mins. Fixed $ $/ Hour (Ft/sec) Speed (Ft/sec^2) Accel/Decel Turn Ang Aisle Path Layer Color
TUG 2 100 115200 0 20 5 5 120 PF_AISLEPATH 1-Red
Update Add Remove
Import Methods
Save Methods
Help
Goto AutoCAD

Step 6. Now select the Process Tab to view the material handling device's LOAD/UNLOAD process information. Processes are an optional way to specify LOAD and UNLOAD time. In this case, we have established an UNLOAD macro time of 15 seconds per location visited plus an additional 15 seconds per CRATE **OR** an additional 9 seconds per BOX. CRATE and BOX are container group names and are assigned to sets of containers that belong to that group. We can see the container group settings in the Containers Tab.

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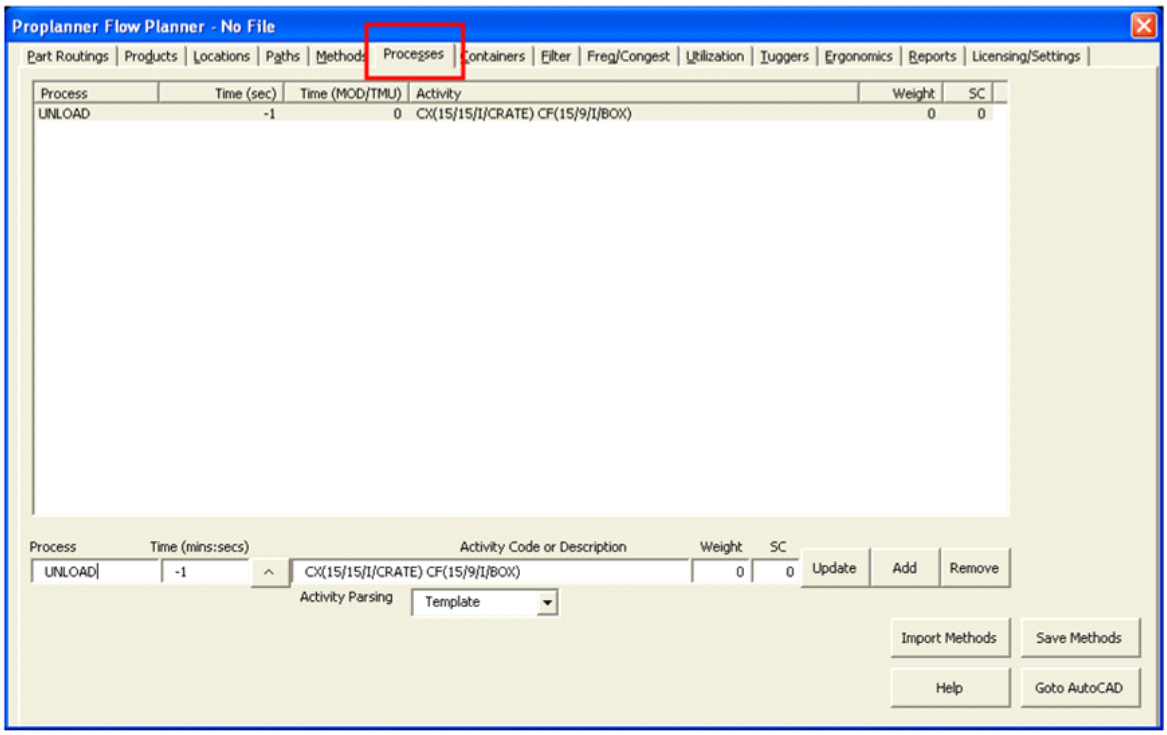

Step 7. Now select the Containers Tab to view the container information. In this window, you can see the container group assignments referred to by the Process tab, and you can also see the sizes of each unique container specified within the deliveries file. Like the Methods Tab, the Containers Tab is automatically created when you load a deliveries file and containers are given a size of 1x1x1 as default. You can specify your sizes in this interface or load the Methods file (MHE) into MS Excel and edit these values there. Container sizes are used by the tugger module to determine the available volume capacity on the tugger carts.

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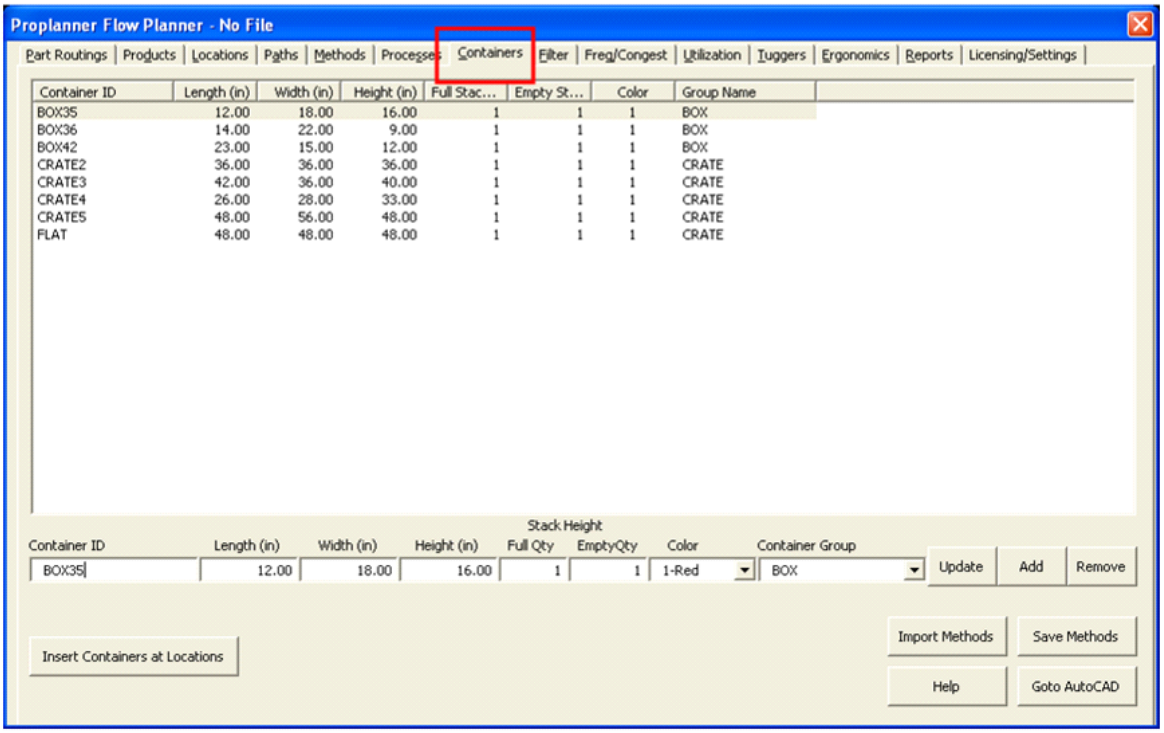
Proplanner Flow Planner - No File
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Container ID | Length (in) | Width (in) | Height (in) | Full Stac... | Empty St... | Color | Group Name
BOX35 12.00 18.00 16.00 1 1 1 BOX
BOX36 14.00 22.00 9.00 1 1 1 BOX
BOX42 23.00 15.00 12.00 1 1 1 BOX
CRATE2 36.00 36.00 36.00 1 1 1 CRATE
CRATE3 42.00 36.00 40.00 1 1 1 CRATE
CRATE4 26.00 28.00 33.00 1 1 1 CRATE
CRATE5 48.00 56.00 48.00 1 1 1 CRATE
FLAT 48.00 48.00 48.00 1 1 1 CRATE
Stack Height
Container ID | Length (in) | Width (in) | Height (in) | Full Qty | EmptyQty | Color | Container Group
BOX35 | 12.00 | 18.00 | 16.00 | 1 | 1 | 1-Red | BOX
Update
Add
Remove
Insert Containers at Locations
Import Methods
Save Methods
Help
Goto AutoCAD

Step 8. Now that Delivery, Location and Route data has been imported and verified, you can create routings by clicking the "Generate Routes" button highlighted in the red box (below). Before selecting this button, you should provide a time for the staging activity (i.e. hookup of carts) which is shown as 30 seconds in the blue box (below), and you should select the Aisle Flow option (directly above the red box). The Aisle Flow option computes the shortest path between delivery locations using the aisles. This option takes longer than the Straight Flow option, but produces more realistic delivery sequences. It is usually best to use the Straight flow option when doing the first few runs to ensure that all of the data is correct, and then select the Aisle Flow option when you are ready for your final validated results.

The GENERATE ROUTES button will assign all of the deliveries to a specific route (based upon which route is assigned to the delivery's FROM and/or TO location (in the Locations tab). The program will then assign that delivery to a specific delivery time slot for that route. For example, in the screen shown below, ZONE1 operates from 7am to 3pm (1500 hours), is dispatched every 10 minutes and has 10 minutes to return from its delivery before it is expected to go out again for the next delivery run. This driver also has a cart capacity of 300 cubic feet and is expected to be able to obtain a 100% packing efficiency (i.e. use all of the available space). The ZONE1 route driver also has 2 Passthru points along the aisle network that he/she must visit sometime during their delivery from STAGE to the TO locations. You will notice that the ZONE2 driver has no Passthru points, and thus can take the most efficient path through the plant for each delivery. NOTE: you will need to adjust the column widths in the the Route Groups list box on the right in order to see all of the fields of data.

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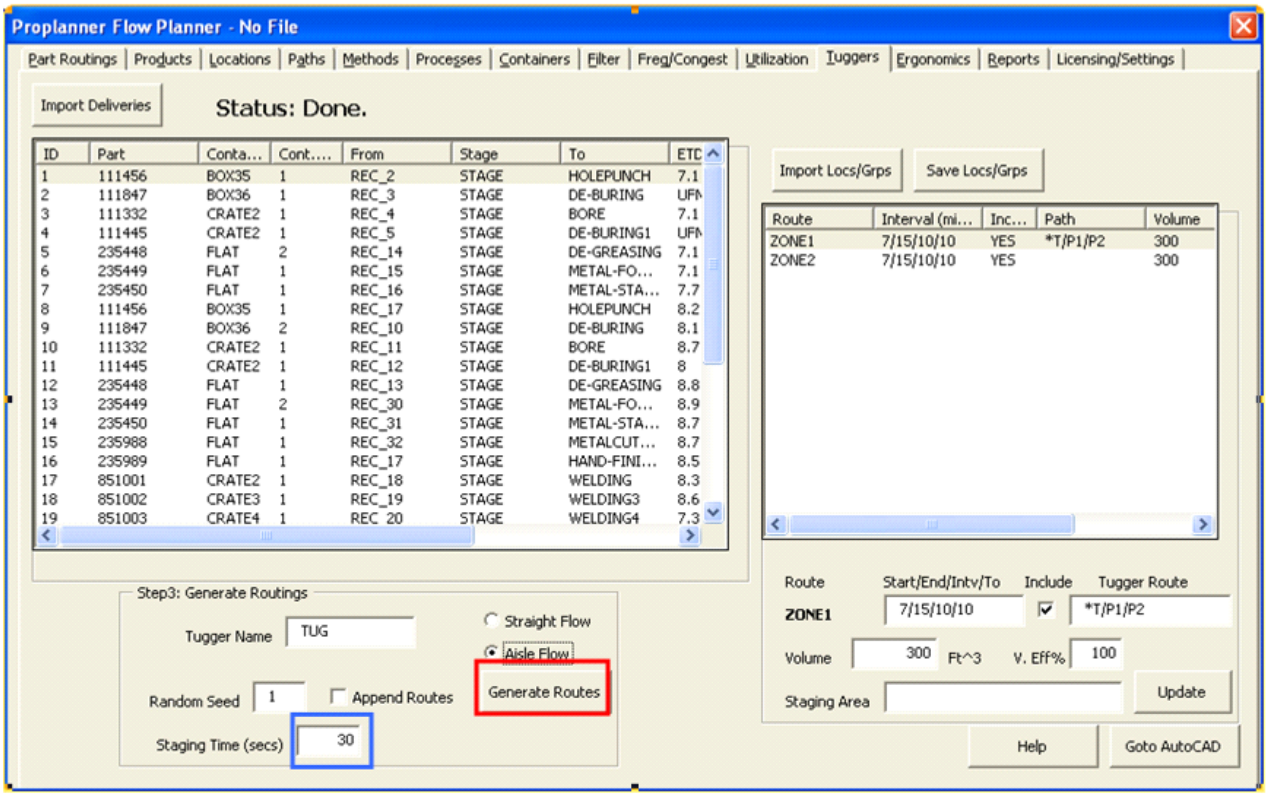
Proplanner Flow Planner - No File
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Import Deliveries
Status: Done.
ID | Part | Conta... | Cont.... | From | Stage | To | ETD
1 | 111456 | BOX35 | 1 | REC_2 | STAGE | HOLEPUNCH | 7.1
2 | 111847 | BOX36 | 1 | REC_3 | STAGE | DE-BURING | UFN
3 | 111332 | CRATE2 | 1 | REC_4 | STAGE | BORE | 7.1
4 | 111445 | CRATE2 | 1 | REC_5 | STAGE | DE-BURING1 | UFN
5 | 235448 | FLAT | 2 | REC_14 | STAGE | DE-GREASING | 7.1
6 | 235449 | FLAT | 1 | REC_15 | STAGE | METAL-FO... | 7.1
7 | 235450 | FLAT | 1 | REC_16 | STAGE | METAL-STA... | 7.7
8 | 111456 | BOX35 | 1 | REC_17 | STAGE | HOLEPUNCH | 8.2
9 | 111847 | BOX36 | 2 | REC_10 | STAGE | DE-BURING | 8.1
10 | 111332 | CRATE2 | 1 | REC_11 | STAGE | BORE | 8.7
11 | 111445 | CRATE2 | 1 | REC_12 | STAGE | DE-BURING1 | 8
12 | 235448 | FLAT | 1 | REC_13 | STAGE | DE-GREASING | 8.8
13 | 235449 | FLAT | 2 | REC_30 | STAGE | METAL-FO... | 8.9
14 | 235450 | FLAT | 1 | REC_31 | STAGE | METAL-STA... | 8.7
15 | 235988 | FLAT | 1 | REC_32 | STAGE | METALCUT... | 8.7
16 | 235989 | FLAT | 1 | REC_17 | STAGE | HAND-FINI... | 8.5
17 | 851001 | CRATE2 | 1 | REC_18 | STAGE | WELDING | 8.3
18 | 851002 | CRATE3 | 1 | REC_19 | STAGE | WELDING3 | 8.6
19 | 851003 | CRATE4 | 1 | REC_20 | STAGE | WELDING4 | 7.3
Import Locs/Grps
Save Locs/Grps
Route | Interval (mi... | Inc... | Path | Volume
ZONE1 | 7/15/10/10 | YES | *T/P1/P2 | 300
ZONE2 | 7/15/10/10 | YES | | 300
Step3: Generate Routings
Tugger Name
TUG
Straight Flow
Aisle Flow
Random Seed
1
Append Routes
Generate Routes
Staging Time (secs)
30
Route
Start/End/Intv/To
Include
Tugger Route
ZONE1
7/15/10/10
*T/P1/P2
Volume
300
Ft^3
V. Eff%
100
Staging Area
Update
Help
Goto AutoCAD

NOTE: If the user wishes for the devices to have mandatory Passthru points, then it will be necessary to enter the names of these Passthru points into the Location Route Groups section under Tugger Route as shown above. These Passthru points must be entered in the order that you want the application to visit them, and the location names must be separated by forward slashes. The user will be prompted for these points when selecting the "Calculate" or "Add Missing Locs" commands.

Step 9. Upon generating routes, the Flow Planner will automatically take you to the Routings tab when it is complete. Each route delivery (i.e. each delivery at each time that a tugger is dispatched on that route) will be generated as a separate Product group. Select the product pull-down list to view the routes that have been created. If a particular route delivery (i.e. ZONE1-07_0 which would be the 7am and 0 minutes dispatch on route 1) is not shown, then this is likely due to the fact that no deliveries were required in the plant between 7am and the next route delivery time.

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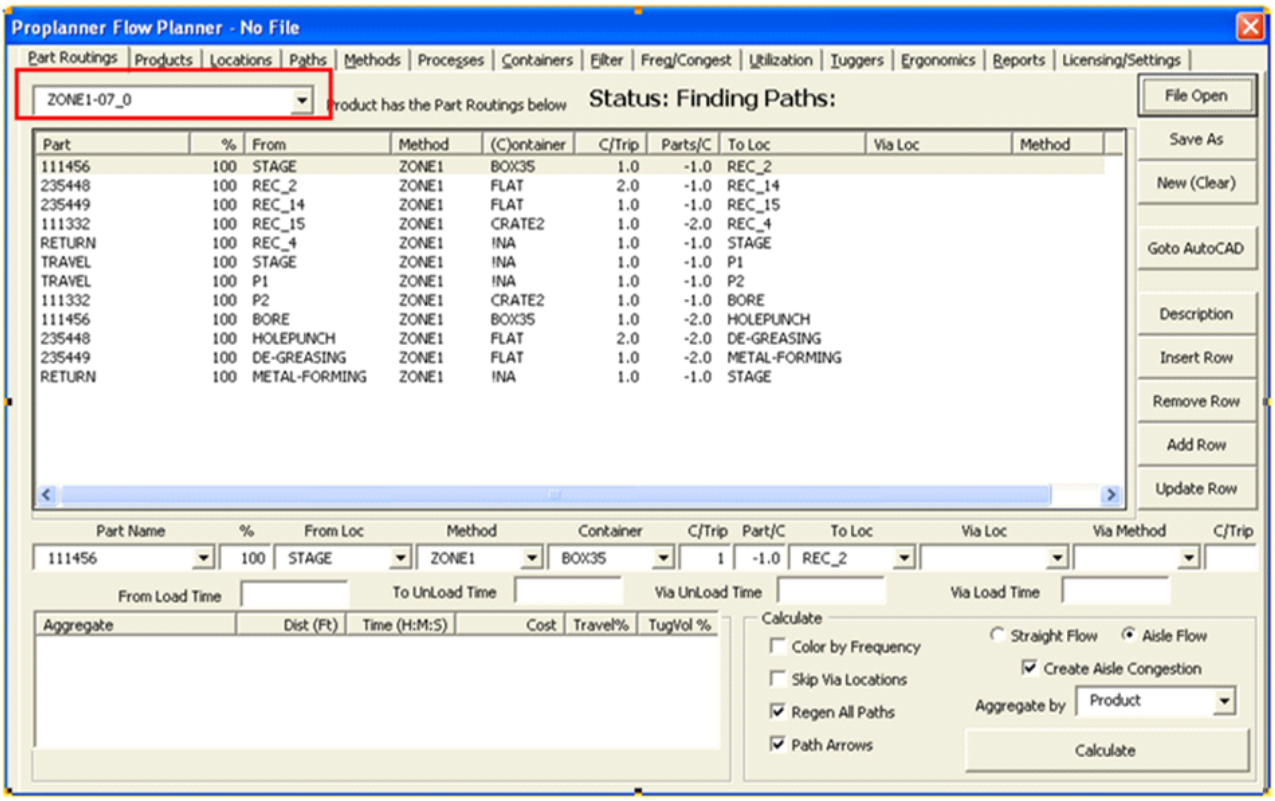
Proplanner Flow Planner - No File
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
ZONE1-07_0
Product has the Part Routings below
Status: Finding Paths:
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Insert Row
Remove Row
Add Row
Update Row
Part | % | From | Method | (C)ontainer | C/Trip | Parts/C | To Loc | Via Loc | Method
111456 100 STAGE ZONE1 BOX35 1.0 -1.0 REC_2
235448 100 REC_2 ZONE1 FLAT 2.0 -1.0 REC_14
235449 100 REC_14 ZONE1 FLAT 1.0 -1.0 REC_15
111332 100 REC_15 ZONE1 CRATE2 1.0 -2.0 REC_4
RETURN 100 REC_4 ZONE1 !NA 1.0 -1.0 STAGE
TRAVEL 100 STAGE ZONE1 !NA 1.0 -1.0 P1
TRAVEL 100 P1 ZONE1 !NA 1.0 -1.0 P2
111332 100 P2 ZONE1 CRATE2 1.0 -1.0 BORE
111456 100 BORE ZONE1 BOX35 1.0 -2.0 HOLEPUNCH
235448 100 HOLEPUNCH ZONE1 FLAT 2.0 -2.0 DE-GREASING
235449 100 DE-GREASING ZONE1 FLAT 1.0 -2.0 METAL-FORMING
RETURN 100 METAL-FORMING ZONE1 !NA 1.0 -1.0 STAGE
Part Name | % | From Loc | Method | Container | C/Trip | Part/C | To Loc | Via Loc | Via Method | C/Trip
111456 | 100 | STAGE | ZONE1 | BOX35 | 1 | -1.0 | REC_2
From Load Time
To UnLoad Time
Via UnLoad Time
Via Load Time
Aggregate | Dist (Ft) | Time (H:M:S) | Cost | Travel% | TugVol %
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by
Product
Calculate

In the screen shown above, you are looking at the deliveries for the route ZONE1 that is dispatched at 7:00am and 0 minutes (07_30 would mean 7.5 hours). This delivery route runs from the STAGE staging area to REC_2, REC_14, REC_15, REC_4 and then back to STAGE and then on to the Passthru points P1 and P2 before going to locations BORE etc. before returning back to the STAGE staging area. The Tugger Route Generator created this sequence of deliveries such that it would minimize the total distance to visit those locations.

Step 10. Now that routes have been created for every time increment, select the Aisle Flow button (shown in the blue box) and then select the Calculate button (red box) to generate your tugger flow diagrams and compute your delivery times and utilizations.

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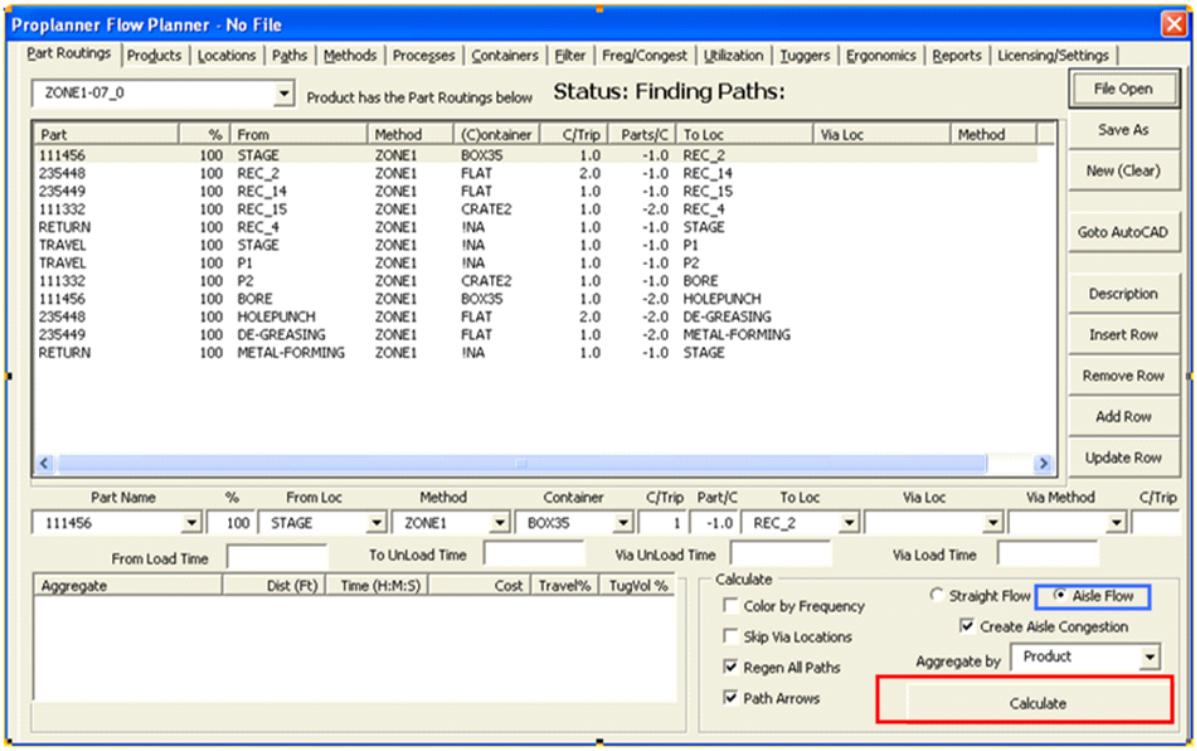

Step 11. Upon selecting "Calculate", you will see the AutoCAD drawing with the added routing lines, similar to below. The flow lines may be difficult to see because they are very thin. If you go to the Paths Tab and set the "Flow Path Thickness Scale" to 1000 and select the "UPDATE" button, your lines will show up much thicker.

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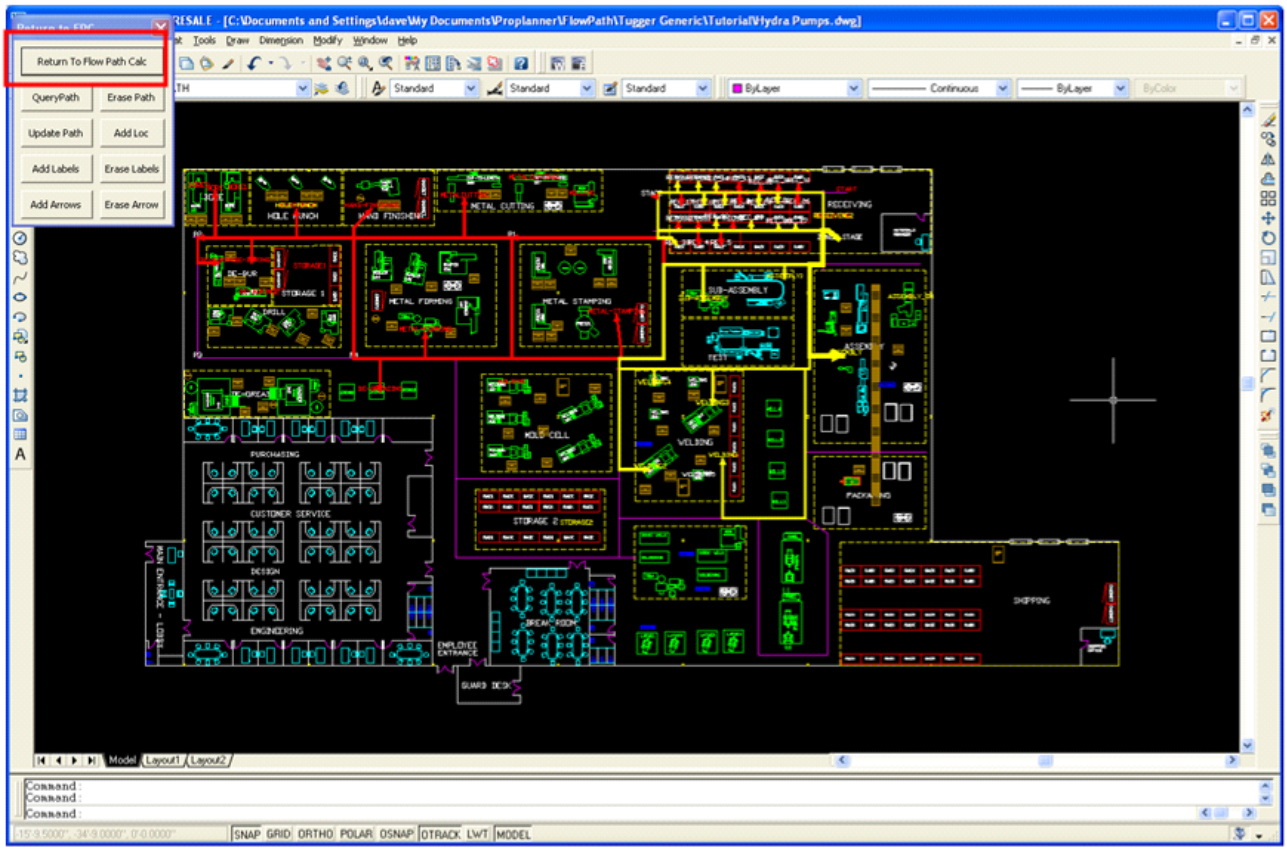

Step 12. In addition to filtering the output by route or locations, you can view utilization charts for each route on the Utilization tab. The first chart shows Traveling vs. Load/Unload time percentages for the last aggregate. In this case it is by route/product.

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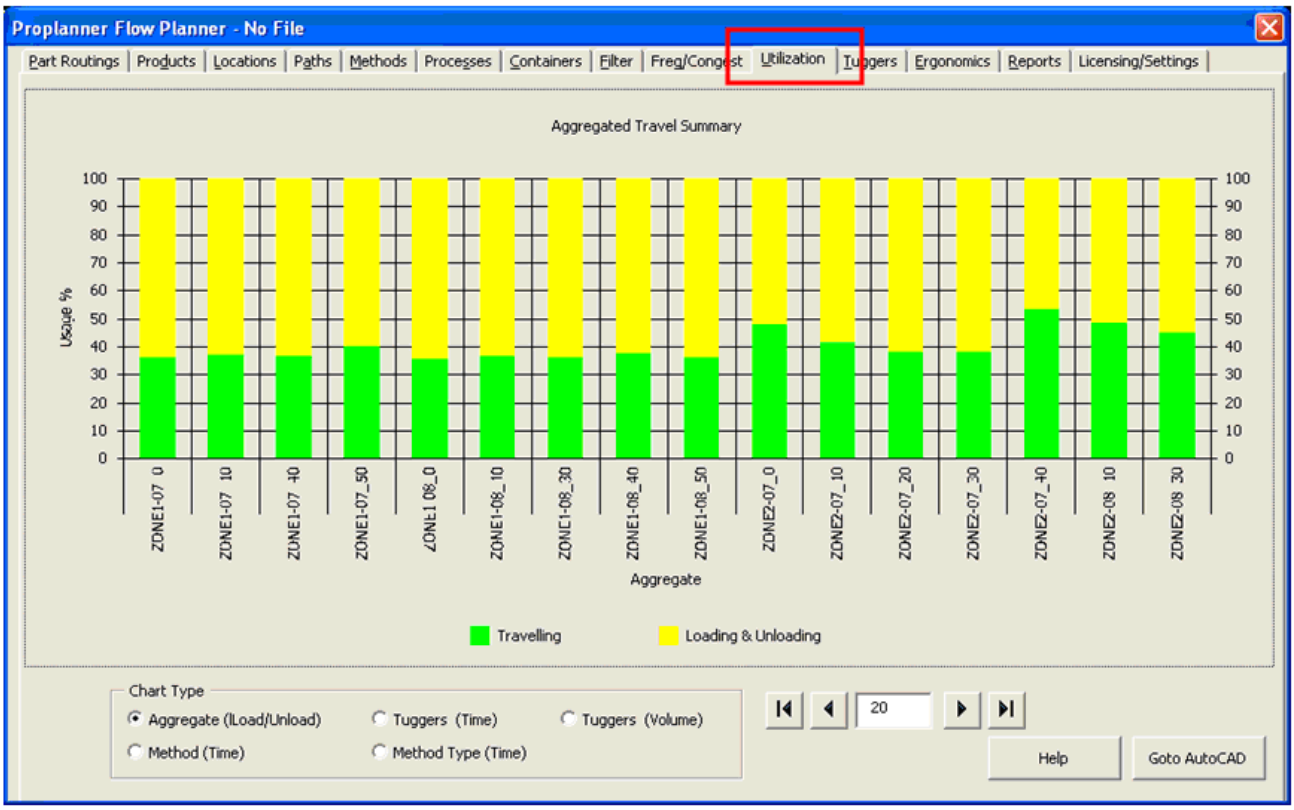

The next chart (select the radio button "Tuggers (Time)" at the bottom middle) shows Busy vs Idle vs Over Utilized time specifically for each route. This will show if more deliveries can be made by that route from a time utilization point of view.

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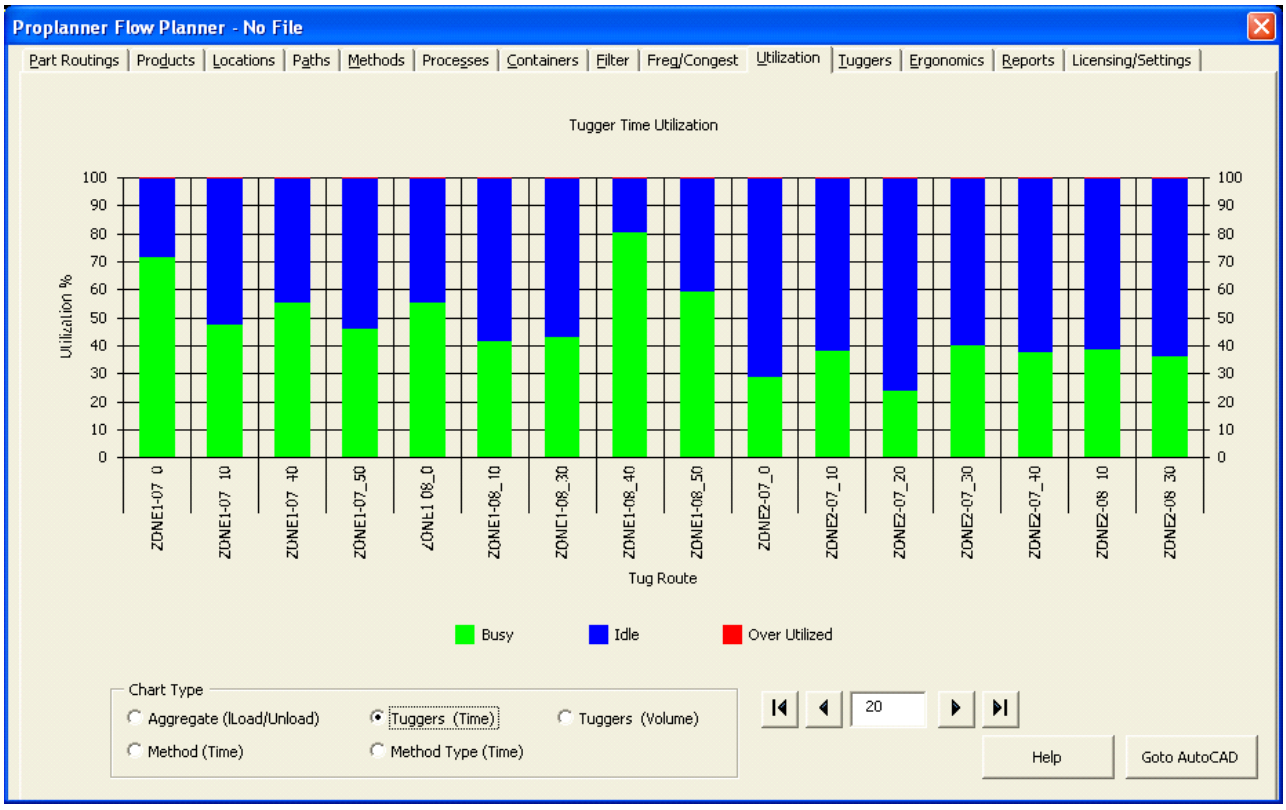

The final chart (select the radio button "Tuggers (Volume)" at the bottom middle) shows Full vs Empty vs Over Utilized volume for each route to help evaluate usage from the total volume perspective. This chart compared to the time chart is telling us that some of the deliveries have too much container volume on them, however there is available capacity before and after those deliveries to resolve this problem.

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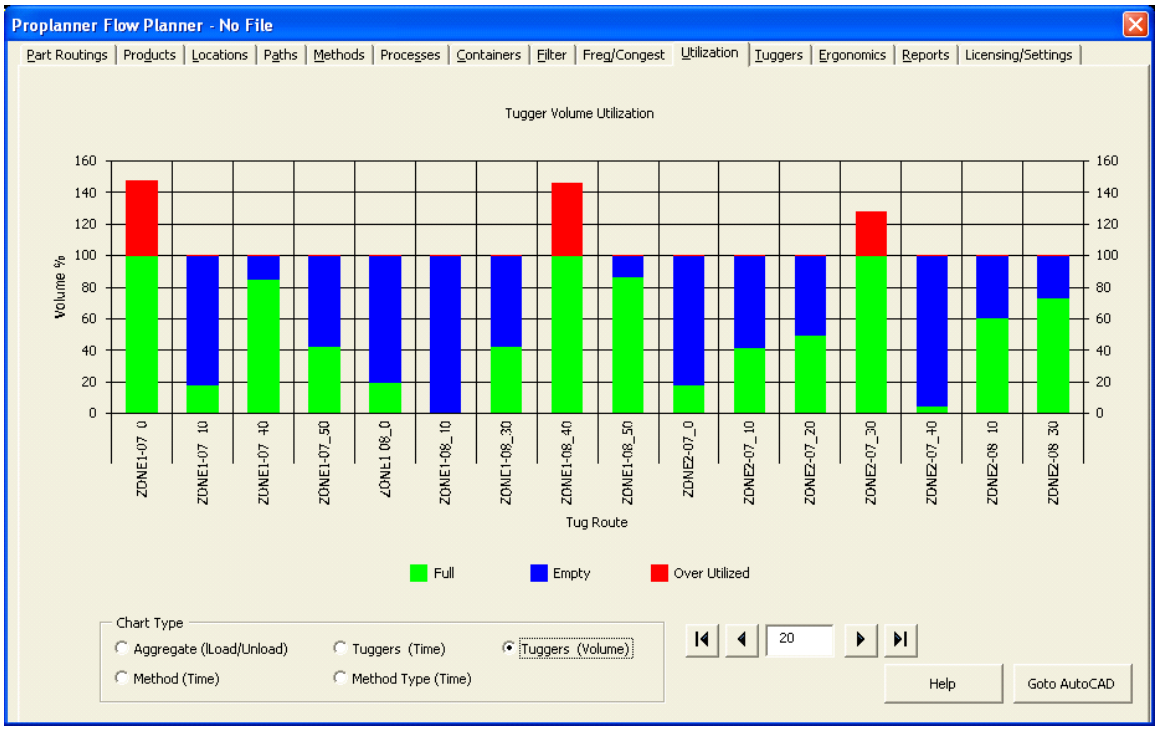

Step 13. Volume percentages are calculated from the available volume information found on the Tuggers tab for each route shown below. This is the cubic unit volume with respect to the drawing units for the space available on the handling device. Also taken into consideration is the volume efficiency of the tugger carts.

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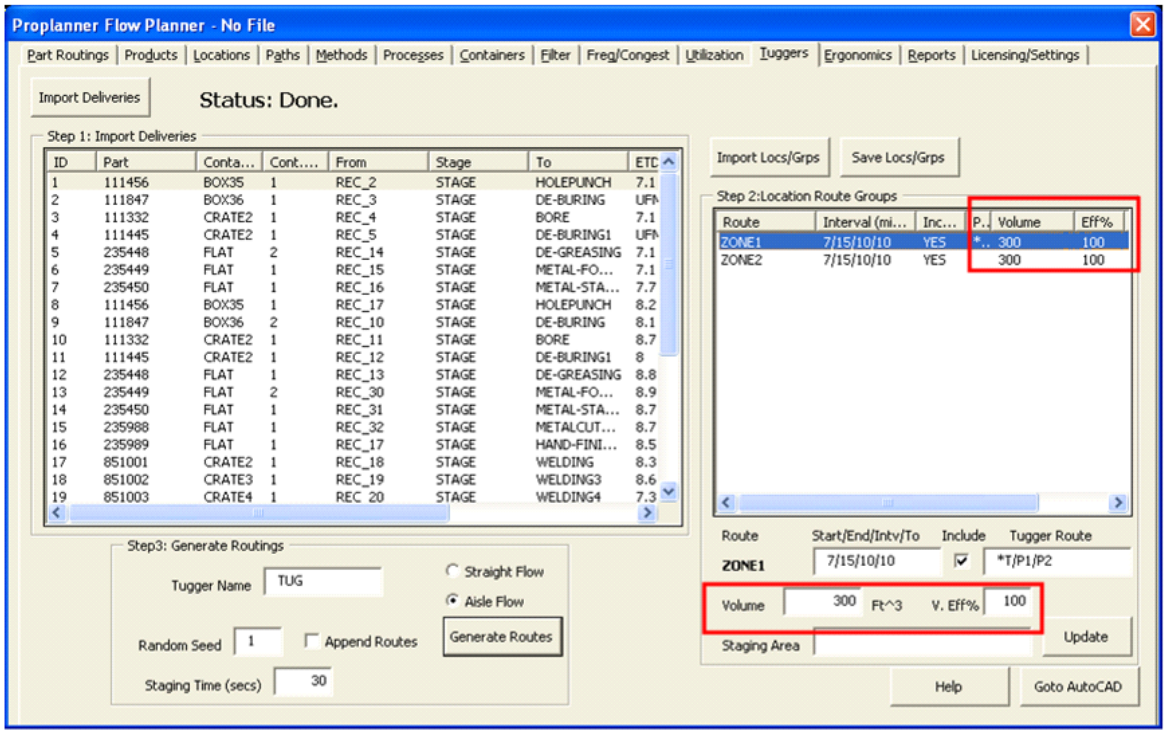
Proplanner Flow Planner - No File
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Tuggers | Ergonomics | Reports | Licensing/Settings
Import Deliveries
Status: Done.
Step 1: Import Deliveries
ID Part Conta... Cont.... From Stage To ETD
1 111456 BOX35 1 REC_2 STAGE HOLEPUNCH 7.1
2 111847 BOX36 1 REC_3 STAGE DE-BURING UFN
3 111332 CRATE2 1 REC_4 STAGE BORE 7.1
4 111445 CRATE2 1 REC_5 STAGE DE-BURING1 UFN
5 235448 FLAT 2 REC_14 STAGE DE-GREASING 7.1
6 235449 FLAT 1 REC_15 STAGE METAL-FO... 7.1
7 235450 FLAT 1 REC_16 STAGE METAL-STA... 7.7
8 111456 BOX35 1 REC_17 STAGE HOLEPUNCH 8.2
9 111847 BOX36 2 REC_10 STAGE DE-BURING 8.1
10 111332 CRATE2 1 REC_11 STAGE BORE 8.7
11 111445 CRATE2 1 REC_12 STAGE DE-BURING1 8
12 235448 FLAT 1 REC_13 STAGE DE-GREASING 8.8
13 235449 FLAT 2 REC_30 STAGE METAL-FO... 8.9
14 235450 FLAT 1 REC_31 STAGE METAL-STA... 8.7
15 235988 FLAT 1 REC_32 STAGE METALCUT... 8.7
16 235989 FLAT 1 REC_17 STAGE HAND-FINI... 8.5
17 851001 CRATE2 1 REC_18 STAGE WELDING 8.3
18 851002 CRATE3 1 REC_19 STAGE WELDING3 8.6
19 851003 CRATE4 1 REC_20 STAGE WELDING4 7.3
Step3: Generate Routings
Tugger Name TUG
Straight Flow
Aisle Flow
Random Seed 1
Append Routes
Generate Routes
Staging Time (secs) 30
Import Locs/Grps
Save Locs/Grps
Step 2:Location Route Groups
Route Interval (mi... Inc... P.. Volume Eff%
ZONE1 7/15/10/10 YES *.. 300 100
ZONE2 7/15/10/10 YES 300 100
Route Start/End/Intv/To Include Tugger Route
ZONE1 7/15/10/10 *T/P1/P2
Volume 300 Ft^3 V. Eff% 100
Staging Area
Update
Help
Goto AutoCAD

Step 14. It is recommended that you have the Flow Planner generate the flow diagrams in the "Straight Flow" technique, to better see where the deliveries are traveling throughout the plant. To do this, return to the first tab on the left, called "Part Routings" and select the "Straight Flow" diagramming option and then select the "Calculate" button, to generate the diagram shown below.

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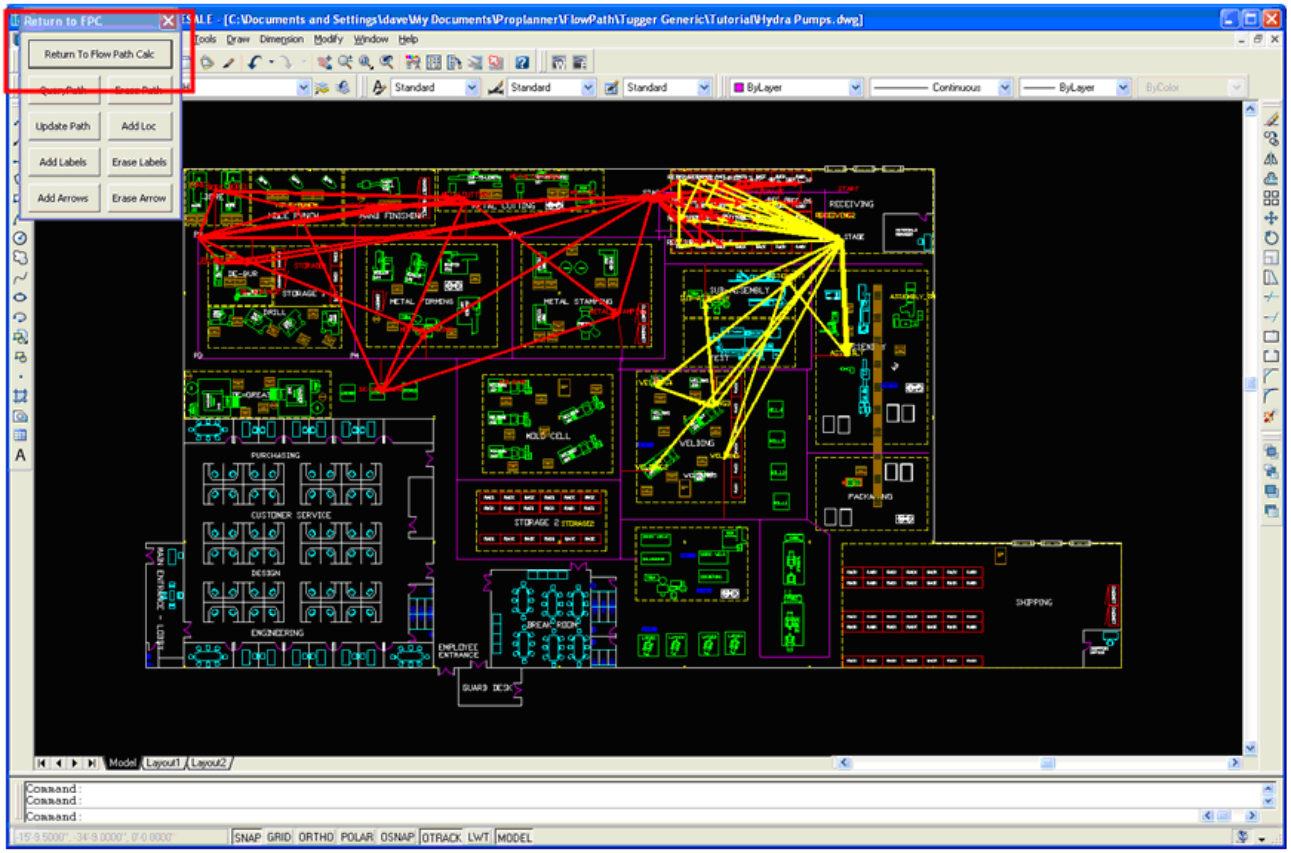

Step 15. To make better sense of this output, you can go to the Filter tab and filter flows for a selected route or set of locations. Select the options shown below to specify ZONE2 at 7:10am between all locations and select the Filter Flows button to see those flows.

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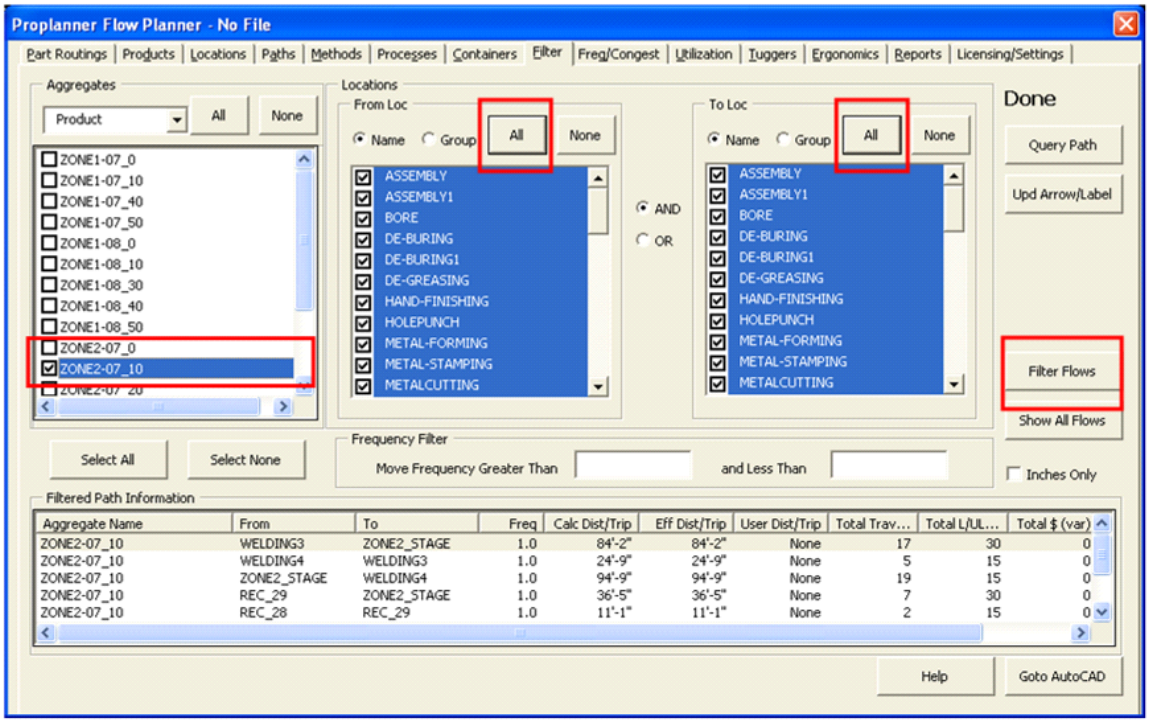

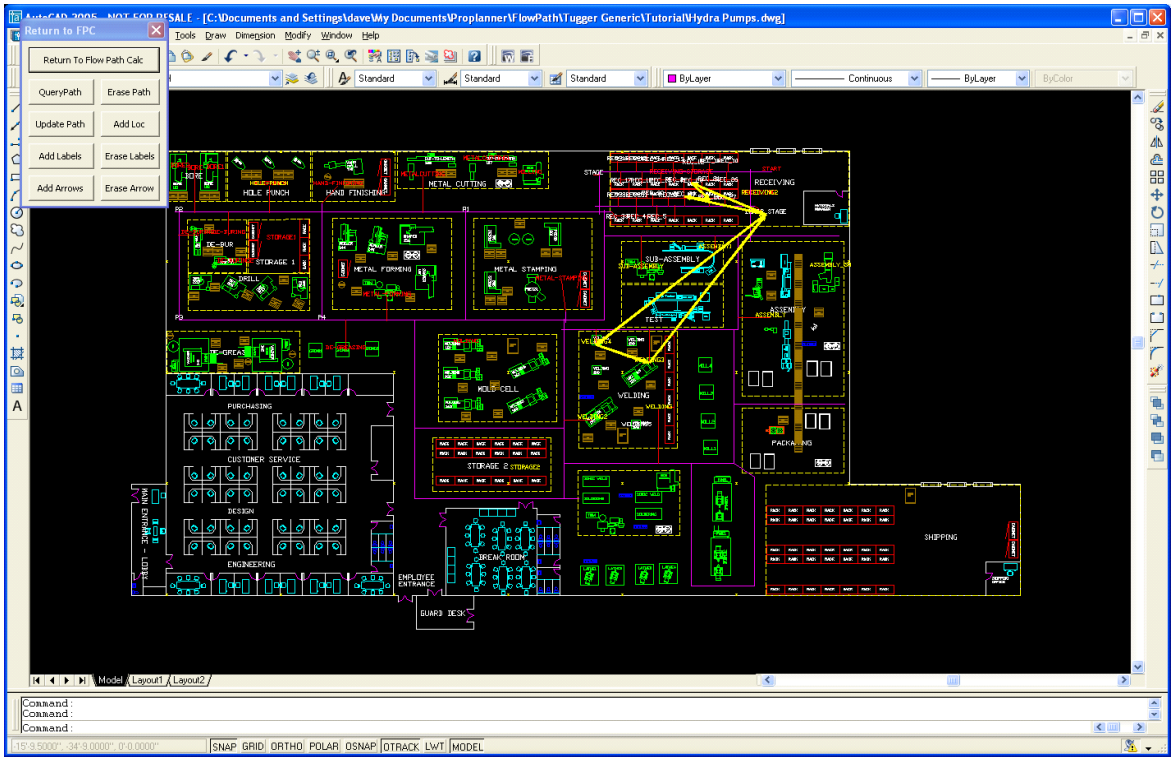

Step 16. To show reports for your actual path distances and times, return to the Flow Planner and go to the Reports tab. Select "Create Report".

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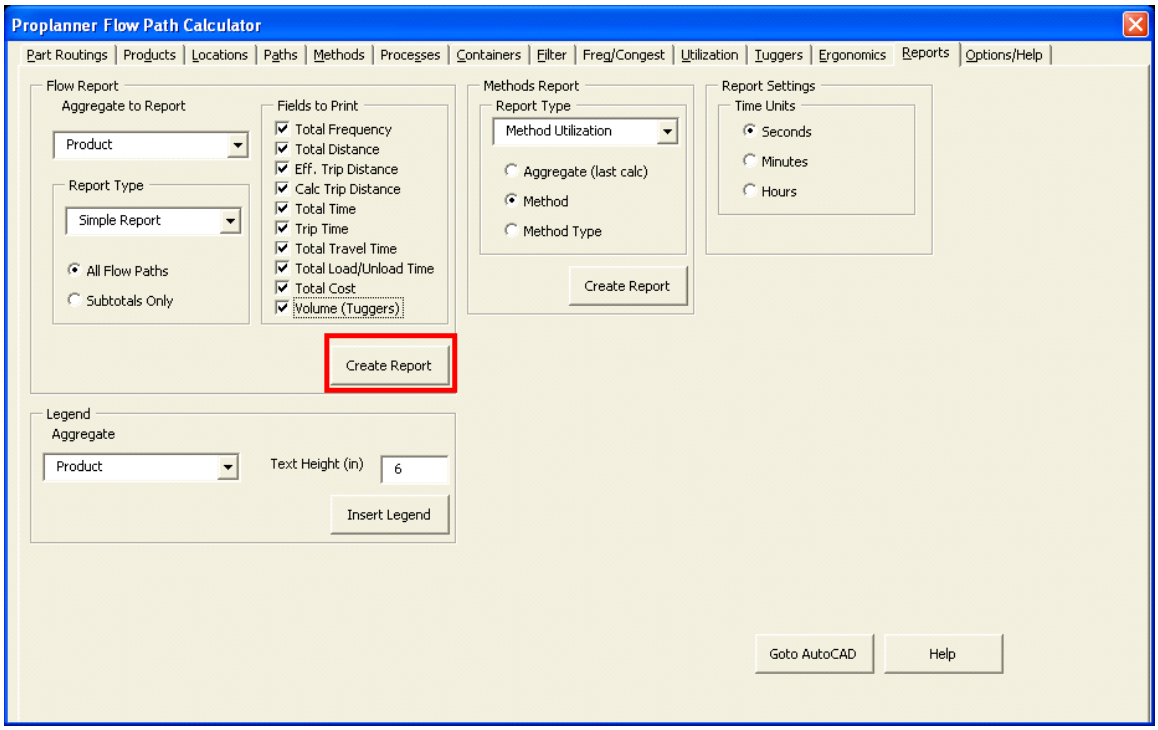

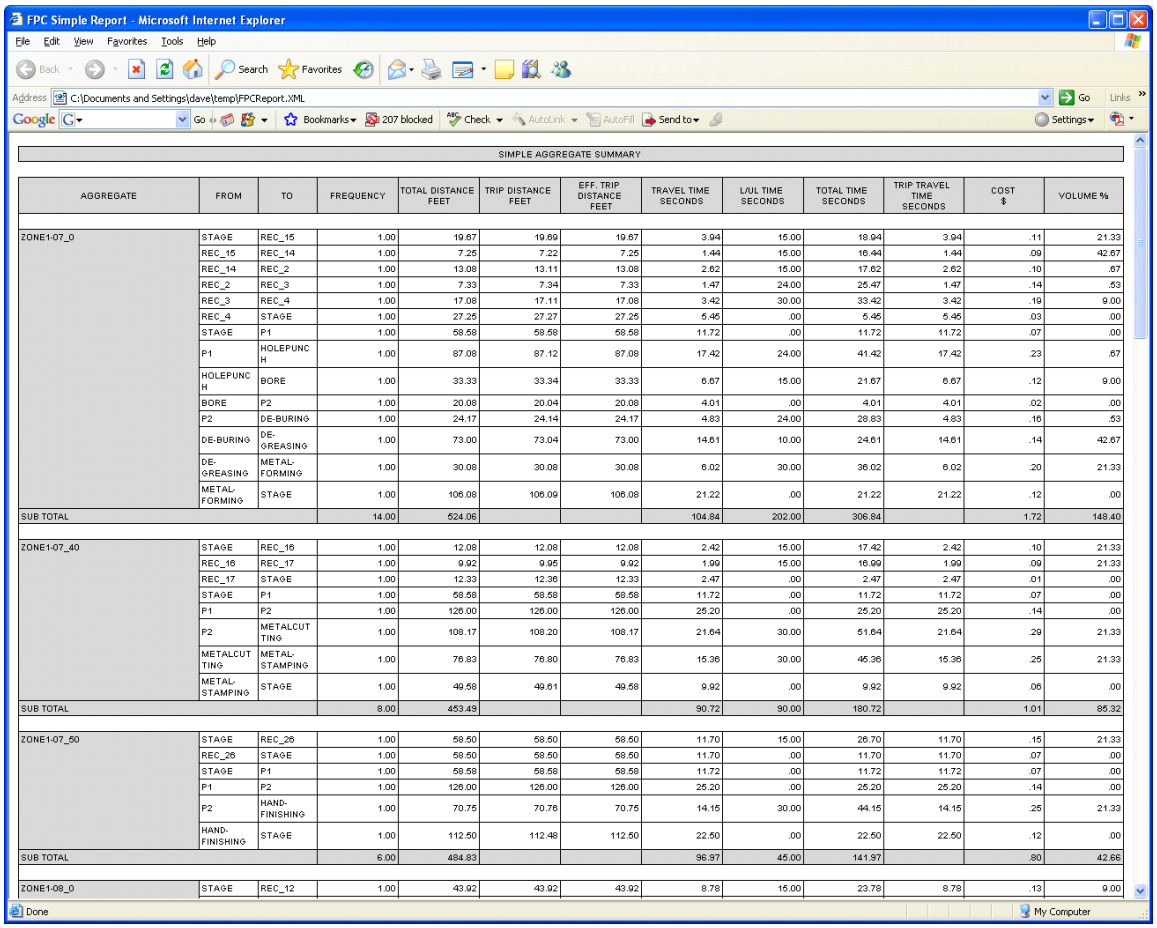
FPC Simple Report - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\Documents and Settings\dave\temp\FPCReport.XML
Done
My Computer

SIMPLE AGGREGATE SUMMARY

AGGREGATE	FROM	TO	FREQUENCY	TOTAL DISTANCE FEET	TRIP DISTANCE FEET	EFF. TRIP DISTANCE FEET	TRAVEL TIME SECONDS	L/UL TIME SECONDS	TOTAL TIME SECONDS	TRIP TRAVEL TIME SECONDS	COST $	VOLUME %
ZONE1-07_0	STAGE	REC_15	1.00	19.67	19.69	19.67	3.94	15.00	18.94	3.94	.11	21.33
	REC_15	REC_14	1.00	7.25	7.22	7.25	1.44	15.00	16.44	1.44	.09	42.67
	REC_14	REC_2	1.00	13.08	13.11	13.08	2.62	15.00	17.62	2.62	.10	.67
	REC_2	REC_3	1.00	7.33	7.34	7.33	1.47	24.00	25.47	1.47	.14	.53
	REC_3	REC_4	1.00	17.08	17.11	17.08	3.42	30.00	33.42	3.42	.19	9.00
	REC_4	STAGE	1.00	27.25	27.27	27.25	5.45	.00	5.45	5.45	.03	.00
	STAGE	P1	1.00	58.58	58.58	58.58	11.72	.00	11.72	11.72	.07	.00
	P1	HOLEPUNCH	1.00	87.08	87.12	87.08	17.42	24.00	41.42	17.42	.23	.67
	HOLEPUNCH	BORE	1.00	33.33	33.34	33.33	6.67	15.00	21.67	6.67	.12	9.00
	BORE	P2	1.00	20.08	20.04	20.08	4.01	.00	4.01	4.01	.02	.00
	P2	DE-BURING	1.00	24.17	24.14	24.17	4.83	24.00	28.83	4.83	.16	.53
	DE-BURING	DE-GREASING	1.00	73.00	73.04	73.00	14.61	10.00	24.61	14.61	.14	42.67
	DE-GREASING	METAL-FORMING	1.00	30.08	30.08	30.08	6.02	30.00	36.02	6.02	.20	21.33
	METAL-FORMING	STAGE	1.00	106.08	106.09	106.08	21.22	.00	21.22	21.22	.12	.00
SUB TOTAL			14.00	524.06			104.84	202.00	306.84		1.72	148.40
ZONE1-07_40	STAGE	REC_16	1.00	12.08	12.08	12.08	2.42	15.00	17.42	2.42	.10	21.33
	REC_16	REC_17	1.00	9.92	9.95	9.92	1.99	15.00	16.99	1.99	.09	21.33
	REC_17	STAGE	1.00	12.33	12.36	12.33	2.47	.00	2.47	2.47	.01	.00
	STAGE	P1	1.00	58.58	58.58	58.58	11.72	.00	11.72	11.72	.07	.00
	P1	P2	1.00	126.00	126.00	126.00	25.20	.00	25.20	25.20	.14	.00
	P2	METALCUTTING	1.00	108.17	108.20	108.17	21.64	30.00	51.64	21.64	.29	21.33
	METALCUTTING	METAL-STAMPING	1.00	76.83	76.80	76.83	15.36	30.00	45.36	15.36	.25	21.33
	METAL-STAMPING	STAGE	1.00	49.58	49.61	49.58	9.92	.00	9.92	9.92	.06	.00
SUB TOTAL			8.00	453.49			90.72	90.00	180.72		1.01	85.32
ZONE1-07_50	STAGE	REC_26	1.00	58.50	58.50	58.50	11.70	15.00	26.70	11.70	.15	21.33
	REC_26	STAGE	1.00	58.50	58.50	58.50	11.70	.00	11.70	11.70	.07	.00
	STAGE	P1	1.00	58.58	58.58	58.58	11.72	.00	11.72	11.72	.07	.00
	P1	P2	1.00	126.00	126.00	126.00	25.20	.00	25.20	25.20	.14	.00
	P2	HAND-FINISHING	1.00	70.75	70.76	70.75	14.15	30.00	44.15	14.15	.25	21.33
	HAND-FINISHING	STAGE	1.00	112.50	112.48	112.50	22.50	.00	22.50	22.50	.12	.00
SUB TOTAL			6.00	484.83			96.97	45.00	141.97		.80	42.66
ZONE1-08_0	STAGE	REC_12	1.00	43.92	43.92	43.92	8.78	15.00	23.78	8.78	.13	9.00

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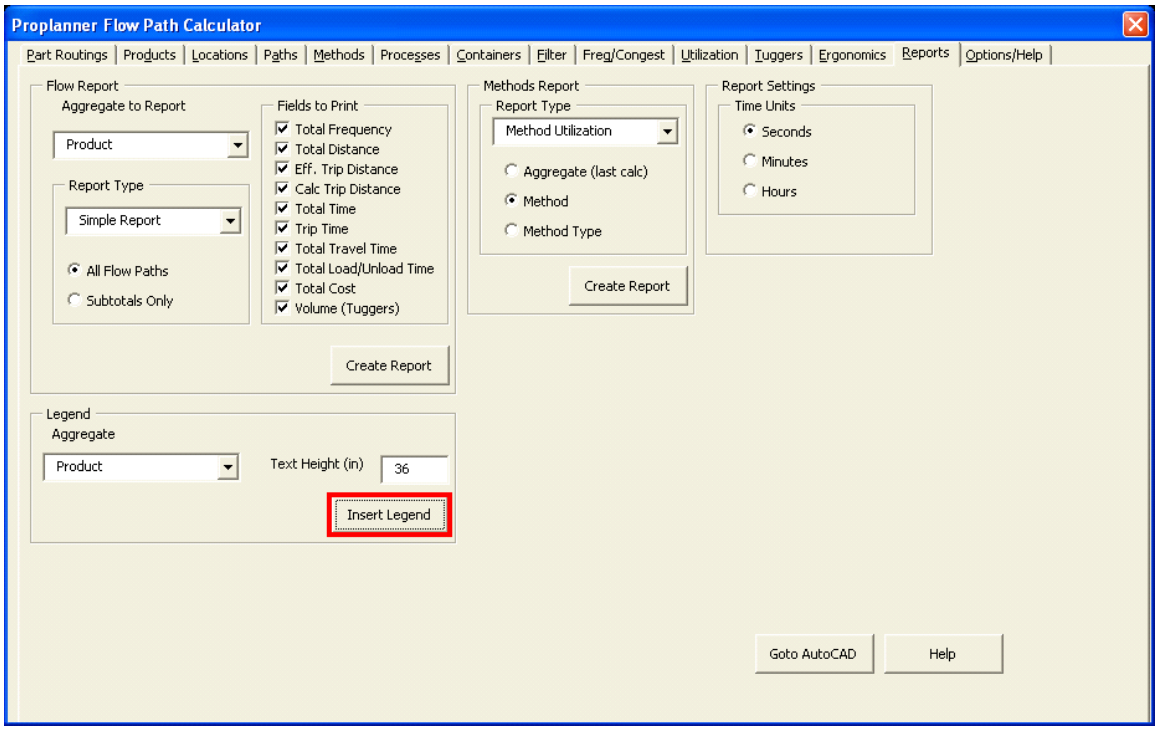
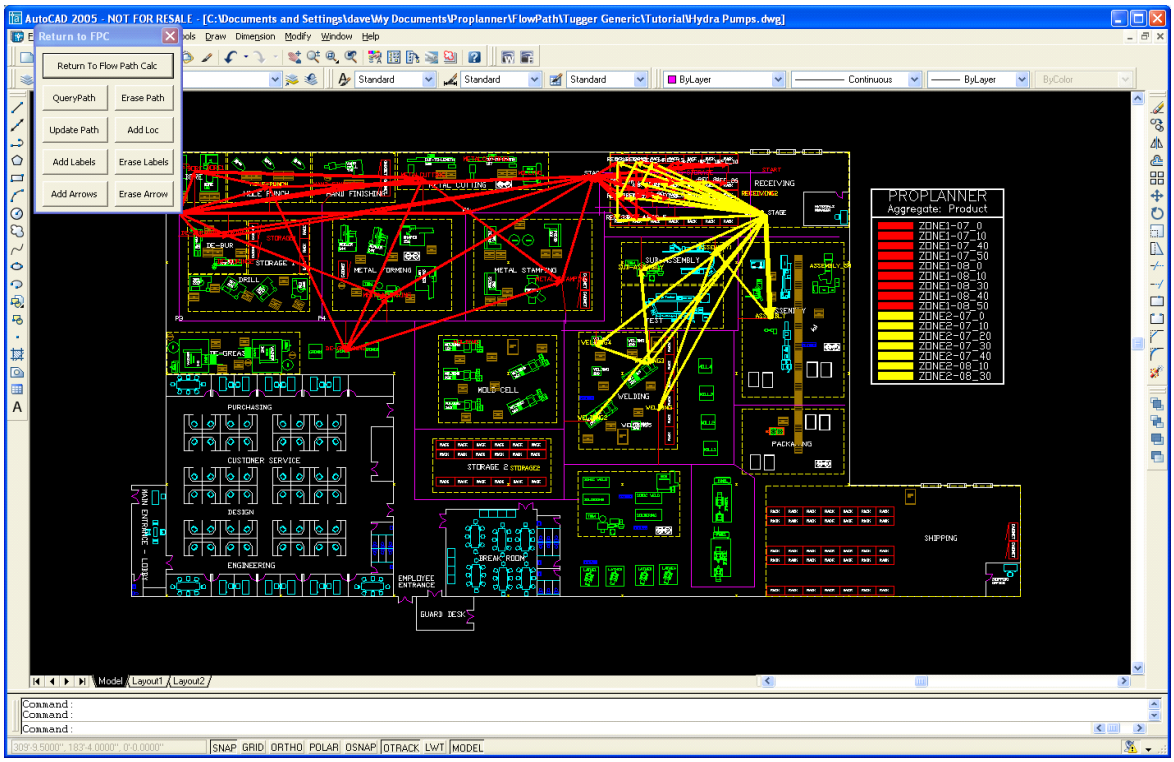
Step 17. Lastly a legend can be created on the Reports tab and used to explain the path color and assign which color represents which aggregate by selecting a text size (try 36 inches) and clicking the "Insert Legend" button and then clicking in the drawing where you would like the legend inserted as shown in the final picture.





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CONGRATULATIONS!!! You have completed your first Proplanner Tugger analysis flow study. Please reference the Tugger module section of the Flow Planner manual for additional information on the many Tugger module options not covered in this tutorial.

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7 Exercises

Plant wide material flow analysis

Special thanks to Dr. Beverly Jaeger at Northeastern University in Boston for creating these exercises

The objective of this exercise will be to use the techniques learned in the Tutorial, along with the aid of the How To Guide and **Sample FP Input** (in Proplanner fold \Help Files\PPFP_Exercise_Samples), to take a simple set of material flow data and perform a complete Flow Planner analysis.

Exercise One: Format a data set for importing to the Flow Planner

Use this **Excel Spreadsheet** (in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP1.xls) of flow and part data along with the **Sample FP Input** to create a CSV and MHE file to import into the FP.

1. To do this extract the data and format it similar to the sample input.
2. Include routing, product, and part information in the CSV and material handling information in the MHE. It will need picked out of the original spreadsheet and re-organized.
3. We will treat quantity of products per day as an input that we know the target value. 1500 will be the goal for MOTOR and 1000 will be the target for TURBINE.
4. The Start Location for the HILO1 method will be RECEIVING and for HILO2 will be SHIPPING. These locations do not matter in the calculation unless referenced in the routings but are needed in the MHE file.
5. Make sure there are no special characters in the CSV data by opening it in notepad. Also remove any superfluous commas at the end of the routing lines. The Sample FP Input has more details on this. Most common errors include spaces and quotation marks.
6. Once the data is set up correctly open the FP within AutoCAD and try opening the CSV. If done correctly the files will open flawlessly.
7. If the files cause an error, consult your instructor or the Troubleshooting Guide.

Results – Flow Planner will open the files with no errors.

Exercise Two: Prepare layout drawing

1. Create layer PF_AISLEPATH in “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex.dwg” by opening the FP while the drawing is open.
2. Insert the names of the locations using the Flow Planner’s Add Location

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command. The location names can be found in the CSV file.
3. Add the aisle path lines with the Add/Edit Aisle Path button on the Paths tab.
4. Attach the locations to aisles with the Join Locs to Aisle button on the Paths tab.
5. Once this is done, open “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv” and “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe” to run an aisle flow calculation.

Results – Flow Planner will not ask user to place locations when a calculation is run. The Aisle Path calculation will not send any straight lines as long as all locations have been attached to the aisle.

Exercise Three: Perform a Euclidian flow study

Using “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex_LOC_AISLE.dwg” instead of the drawing file just created, along with “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv” and “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe” will ensure that we get the same results when this exercise is complete.

1. Open the drawing and notice that all the locations have been placed as in exercise two.
2. Start the Flow Planner and open the CSV and MHE files mentioned above. They should be identical for the most part to the files created in the first exercise.
3. Check the Routings, Products, and Methods tabs to make sure all the data has been imported.
4. Go to the Options tab to ensure that the units are in feet and inches.
5. Return to the Routings tab and select the Straight Flow radio button.
6. Run the calculation. A Euclidian or straight line study will now be drawn on the AutoCAD drawing.
7. Because there is more work than one transport device can do in the week, the program will say it is over utilized and offer to automatically increase the number of the appropriate device. Click yes.
8. Now that the calculation is complete, return to the Routings tab and look at the Results Window in the lower left side of the FP window.

Results – The results window should equal those below if the calculation has been run correctly.

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Results

Aggregate	Dist (Ft)	Time (H:M:S)	Cost	Travel%
MOTOR	527122'-4"	44:38:11	$893	22
TURBINE	354825'-2"	26:1:45	$521	25
Total	881947'-5"	70:39:56	$1,633	23

Exercise Four: Perform an aisle based flow study

Using “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex_LOC_AISLE.dwg” instead of the drawing just created, along with “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv” and “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe” will ensure that we get the same results when this exercise is complete. - If you just completed exercise three, skip to step five.

1. Open the drawing and notice that all the locations have been placed as in exercise two.
2. Start the Flow Planner and open the CSV and MHE files mentioned above. They should be identical for the most part to the files created in the first exercise.
3. Check the Routings, Products, and Methods tabs to make sure all the data has been imported.
4. Go to the Options tab to ensure that the units are in feet and inches.
5. Return to the Routings tab and select the Aisle Flow radio button.
6. Run the calculation. An Aisle Path study will now be drawn on the AutoCAD drawing.
7. Because there is more work than one transport device can do in the week, the program will say it is over utilized and offer to automatically increase the number of the appropriate device. Click yes.
8. Now that the calculation is complete, return to the Routings tab and look at the Results Window in the lower left side of the FP window.

Results – The results window should equal those below if the calculation has been run correctly.

Results

Aggregate	Dist (Ft)	Time (H:M:S)	Cost	Travel%
MOTOR	781698'-4"	49:21:3	$987	29
TURBINE	465648'-6"	28:4:53	$562	31
Total	1247346'-11"	77:25:56	$1,879	30

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Exercise Five: Analyze the congestion diagram created by the Flow Planner

Using “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex_LOC_AISLE.dwg” instead of the drawing just created, along with “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv” and “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe” will ensure that we get the same results when this exercise is complete. - If you just completed exercise four, skip to step six.

1. Open the drawing and notice that all the locations have been placed as in exercise two.
2. Start the Flow Planner and open the CSV and MHE files mentioned above. They should be identical for the most part to the files created in the first exercise.
3. Check the Routings, Products, and Methods tabs to make sure all the data has been imported.
4. Go to the Options tab to ensure that the units are in feet and inches.
5. Return to the Routings tab and select the Aisle Flow radio button.
6. Make sure that the check box for Create Aisle Congestion is checked.
7. Run the calculation. An Aisle Path study will now be drawn on the AutoCAD drawing and the congestion data has been created.
8. Go to the Freq/Congestion tab to switch the view to congestion and hit update to be taken to the drawing with congestion data drawn on the aisle paths.

Results – You will see the top five percent of flows located on the incoming/outgoing path from the shipping and receiving docks. If you do a Query Path on the line you will see that it has 3,535 trips as its frequency.

This amount of traffic over such a large aisle path can be a safety risk for the operators. This can also cause handling devices to need un-necessary amounts of maintenance or delays, dependant on aisle width and raise their costs. This kind of problem requires a layout or aisle path redesign.

Exercise Six: Rearrange layout to reduce congestion and improve throughput

You may wish to alter the drawing a few ways. For the sake of matching output, do a calculation on the drawing “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex_LOC_AISLE_2.dwg” using the same “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv” and “in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe” as before.

There are several ways to improve layout, the most obvious of which being to push locations closer together. In this case the product assembly areas were assumed to

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be monumental. Only the aisle paths and dock input/output sides have been changed to take advantage of being closer to their use locations and avoid aisle crossovers between the shipping and receiving dock traffic.

Results – The area of highest congestion has now been minimized to a small area near receiving and the congestion over which is only 2952.5 trips. That's over a 16% reduction of congestion in the area of highest concentration and a drastic reduction in space in which the major congestion lies.

Additionally, the results which should match those given below have been improved by 128840.4 feet in reduced travel distance and nearly fifteen minutes of total time saved.

Results

Aggregate	Dist (Ft)	Time (H:M:S)	Cost	Travel%
MOTOR	670367'-6"	47:17:21	$946	26
TURBINE	448139'	27:45:26	$555	30
Total	1118506'-7"	75:2:47	$1,831	28

Exercise Seven: Adjust product/part quantities and method information to predict future state

Looking at this data, the engineer can see that there is large room for improvement or altering the product quantities produced. Assuming that demand for this product will grow, what happens when the amount manufactured needs to be increased? To do this analysis the operator only needs to alter the product information to have the new quantities. With these changes, the program will automatically change the number of handling devices used after informing the user that the route is over utilized.

1. Open the drawing "in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP_Ex_LOC_AISLE.dwg" and "in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.csv" and "in Proplanner fold \Help Files\PPFP_Exercise_Samples\FP2.mhe".
2. On the Products tab increase the quantity of MOTOR to 3000 and TURBINE to 2000 to simulate increase in production quantities. This can also be used to simulate a reduction in available method time by altering the Method Type available minutes on the Methods tab.
3. Run an Aisle Flow calculation to best evaluate the real distance.
4. Select Yes when the over utilization dialogue boxes pop up. This will change the number of material handling devices as necessary.
5. View the changes to the method handling device quantities on the Methods tab.
6. Save the routing files as different file names to save that alternative scenario for

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future analysis.

Results – The operator can see that despite drastic increases in demand, the optimized material flow patterns only require an increase of two operators by looking at the Methods tab. Additionally, they have all the distance, time, and cost evaluation data figured without doing a test run on the line.

Results

Aggregate	Dist (Ft)	Time (H:M:S)	Cost	Travel%
MOTOR	1340735'	94:34:42	$1,892	26
TURBINE	896278'-1"	55:30:52	$1,110	30
Total	2237013'-1"	150:5:34	$3,552	28

This method can be used to determine the outcome of several different material information changes. Additionally for all the devices, the operator can track their utilization percentages and decide how much time they can spend doing other tasks. Assuming the work locations are movable, large amounts of plant space can be saved as well.

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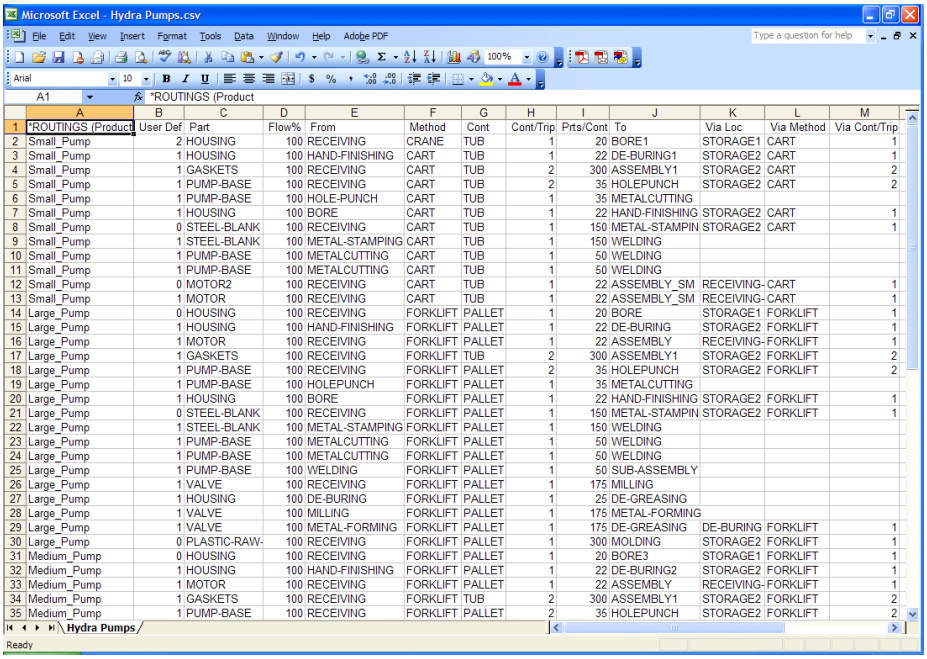
8 How To Guide

Plant wide material flow analysis

Base steps:

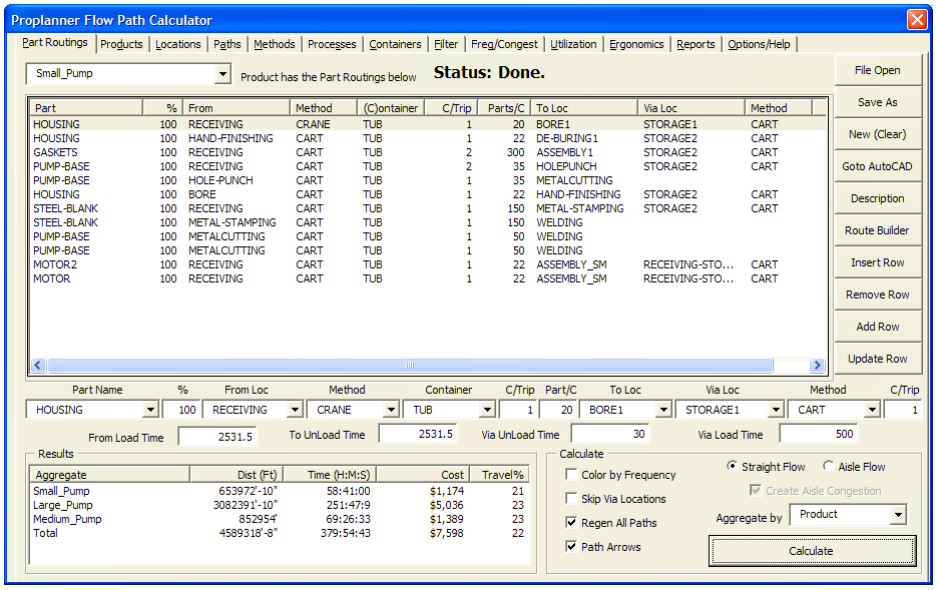
1. Import plant drawing to AutoCAD.

2. Input routing information either by using Excel to copy and paste the larger quantities of information into the proper columns to be imported directly to FP, or using our route building editor.


Microsoft Excel - Hydra Pumps.csv

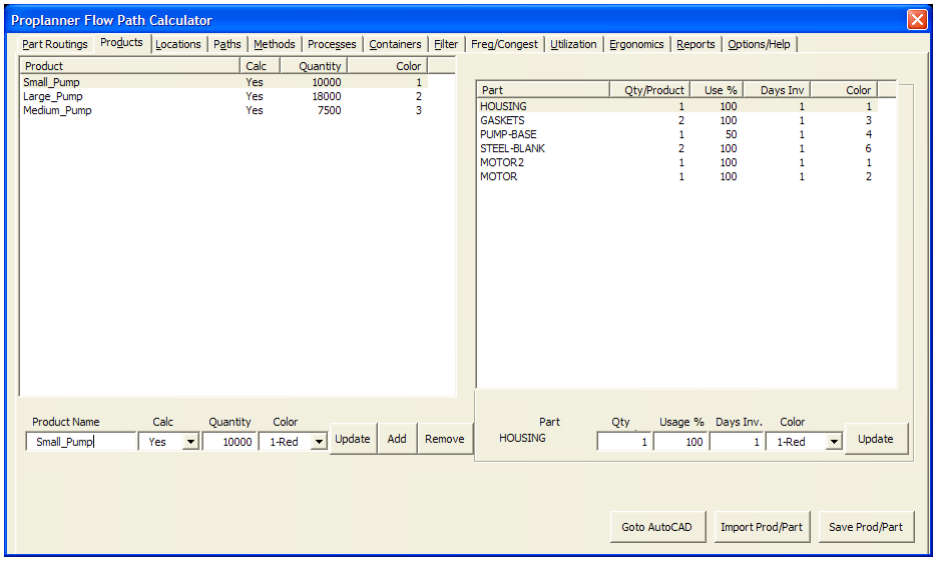
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	*ROUTINGS (Product	User Def	Part	Flow%	From	Method	Cont	Cont/Trip	Prts/Cont	To	Via Loc	Via Method	Via Cont/Trip
2	Small_Pump	2	HOUSING	100	RECEIVING	CRANE	TUB	1	20	BORE1	STORAGE1	CART	1
3	Small_Pump	1	HOUSING	100	HAND-FINISHING	CART	TUB	1	22	DE-BURING1	STORAGE2	CART	1
4	Small_Pump	1	GASKETS	100	RECEIVING	CART	TUB	2	300	ASSEMBLY1	STORAGE2	CART	2
5	Small_Pump	1	PUMP-BASE	100	RECEIVING	CART	TUB	2	35	HOLEPUNCH	STORAGE2	CART	2
6	Small_Pump	1	PUMP-BASE	100	HOLE-PUNCH	CART	TUB	1	35	METALCUTTING			
7	Small_Pump	1	HOUSING	100	BORE	CART	TUB	1	22	HAND-FINISHING	STORAGE2	CART	1
8	Small_Pump	0	STEEL-BLANK	100	RECEIVING	CART	TUB	1	150	METAL-STAMPIN	STORAGE2	CART	1
9	Small_Pump	1	STEEL-BLANK	100	METAL-STAMPING	CART	TUB	1	150	WELDING			
10	Small_Pump	1	PUMP-BASE	100	METALCUTTING	CART	TUB	1	50	WELDING			
11	Small_Pump	1	PUMP-BASE	100	METALCUTTING	CART	TUB	1	50	WELDING			
12	Small_Pump	0	MOTOR2	100	RECEIVING	CART	TUB	1	22	ASSEMBLY_SM	RECEIVING-	CART	1
13	Small_Pump	1	MOTOR	100	RECEIVING	CART	TUB	1	22	ASSEMBLY_SM	RECEIVING-	CART	1
14	Large_Pump	0	HOUSING	100	RECEIVING	FORKLIFT	PALLET	1	20	BORE	STORAGE1	FORKLIFT	1
15	Large_Pump	1	HOUSING	100	HAND-FINISHING	FORKLIFT	PALLET	1	22	DE-BURING	STORAGE2	FORKLIFT	1
16	Large_Pump	1	MOTOR	100	RECEIVING	FORKLIFT	PALLET	1	22	ASSEMBLY	RECEIVING-	FORKLIFT	1
17	Large_Pump	1	GASKETS	100	RECEIVING	FORKLIFT	TUB	2	300	ASSEMBLY1	STORAGE2	FORKLIFT	2
18	Large_Pump	1	PUMP-BASE	100	RECEIVING	FORKLIFT	PALLET	2	35	HOLEPUNCH	STORAGE2	FORKLIFT	2
19	Large_Pump	1	PUMP-BASE	100	HOLEPUNCH	FORKLIFT	PALLET	1	35	METALCUTTING			
20	Large_Pump	1	HOUSING	100	BORE	FORKLIFT	PALLET	1	22	HAND-FINISHING	STORAGE2	FORKLIFT	1
21	Large_Pump	0	STEEL-BLANK	100	RECEIVING	FORKLIFT	PALLET	1	150	METAL-STAMPIN	STORAGE2	FORKLIFT	1
22	Large_Pump	1	STEEL-BLANK	100	METAL-STAMPING	FORKLIFT	PALLET	1	150	WELDING			
23	Large_Pump	1	PUMP-BASE	100	METALCUTTING	FORKLIFT	PALLET	1	50	WELDING			
24	Large_Pump	1	PUMP-BASE	100	METALCUTTING	FORKLIFT	PALLET	1	50	WELDING			
25	Large_Pump	1	PUMP-BASE	100	WELDING	FORKLIFT	PALLET	1	50	SUB-ASSEMBLY			
26	Large_Pump	1	VALVE	100	RECEIVING	FORKLIFT	PALLET	1	175	MILLING			
27	Large_Pump	1	HOUSING	100	DE-BURING	FORKLIFT	PALLET	1	25	DE-GREASING			
28	Large_Pump	1	VALVE	100	MILLING	FORKLIFT	PALLET	1	175	METAL-FORMING			
29	Large_Pump	1	VALVE	100	METAL-FORMING	FORKLIFT	PALLET	1	175	DE-GREASING	DE-BURING	FORKLIFT	1
30	Large_Pump	0	PLASTIC-RAW-	100	RECEIVING	FORKLIFT	PALLET	1	300	MOLDING	STORAGE2	FORKLIFT	1
31	Medium_Pump	0	HOUSING	100	RECEIVING	FORKLIFT	PALLET	1	20	BORE3	STORAGE1	FORKLIFT	1
32	Medium_Pump	1	HOUSING	100	HAND-FINISHING	FORKLIFT	PALLET	1	22	DE-BURING2	STORAGE2	FORKLIFT	1
33	Medium_Pump	1	MOTOR	100	RECEIVING	FORKLIFT	PALLET	1	22	ASSEMBLY	RECEIVING-	FORKLIFT	1
34	Medium_Pump	1	GASKETS	100	RECEIVING	FORKLIFT	TUB	2	300	ASSEMBLY1	STORAGE2	FORKLIFT	2
35	Medium_Pump	1	PUMP-BASE	100	RECEIVING	FORKLIFT	PALLET	2	35	HOLEPUNCH	STORAGE2	FORKLIFT	2

Excel


Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Small_Pump
Product has the Part Routings below
Status: Done.
File Open
Save As
New (Clear)
Goto AutoCAD
Description
Route Builder
Insert Row
Remove Row
Add Row
Update Row
Part | % | From | Method | (C)ontainer | C/Trip | Parts/C | To Loc | Via Loc | Method
HOUSING 100 RECEIVING CRANE TUB 1 20 BORE1 STORAGE1 CART
HOUSING 100 HAND-FINISHING CART TUB 1 22 DE-BURING1 STORAGE2 CART
GASKETS 100 RECEIVING CART TUB 2 300 ASSEMBLY1 STORAGE2 CART
PUMP-BASE 100 RECEIVING CART TUB 2 35 HOLEPUNCH STORAGE2 CART
PUMP-BASE 100 HOLE-PUNCH CART TUB 1 35 METALCUTTING
HOUSING 100 BORE CART TUB 1 22 HAND-FINISHING STORAGE2 CART
STEEL-BLANK 100 RECEIVING CART TUB 1 150 METAL-STAMPING STORAGE2 CART
STEEL-BLANK 100 METAL-STAMPING CART TUB 1 150 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
PUMP-BASE 100 METALCUTTING CART TUB 1 50 WELDING
MOTOR2 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
MOTOR 100 RECEIVING CART TUB 1 22 ASSEMBLY_SM RECEIVING-STO... CART
Part Name | % | From Loc | Method | Container | C/Trip | Part/C | To Loc | Via Loc | Method | C/Trip
HOUSING 100 RECEIVING CRANE TUB 1 20 BORE1 STORAGE1 CART 1
From Load Time 2531.5
To UnLoad Time 2531.5
Via UnLoad Time 30
Via Load Time 500
Results
Aggregate | Dist (Ft) | Time (H:M:S) | Cost | Travel%
Small_Pump 653972'-10" 58:41:00 $1,174 21
Large_Pump 3082391'-10" 251:47:9 $5,036 23
Medium_Pump 85295' 69:26:33 $1,389 23
Total 4589318'-8" 379:54:43 $7,598 22
Calculate
Color by Frequency
Skip Via Locations
Regen All Paths
Path Arrows
Straight Flow
Aisle Flow
Create Aisle Congestion
Aggregate by Product
Calculate

Route building editor

3. Select the product and part Tab and adjust your quantities as shown below.


Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Product | Calc | Quantity | Color
Small_Pump Yes 10000 1
Large_Pump Yes 18000 2
Medium_Pump Yes 7500 3
Part | Qty/Product | Use % | Days Inv | Color
HOUSING 1 100 1 1
GASKETS 2 100 1 3
PUMP-BASE 1 50 1 4
STEEL-BLANK 2 100 1 6
MOTOR2 1 100 1 1
MOTOR 1 100 1 2
Product Name | Calc | Quantity | Color
Small_Pump Yes 10000 1-Red
Update
Add
Remove
Part | Qty | Usage % | Days Inv. | Color
HOUSING 1 100 1 1-Red
Update
Goto AutoCAD
Import Prod/Part
Save Prod/Part

Products and parts editor

4. Select the Methods Tab and adjust your quantities as shown below.

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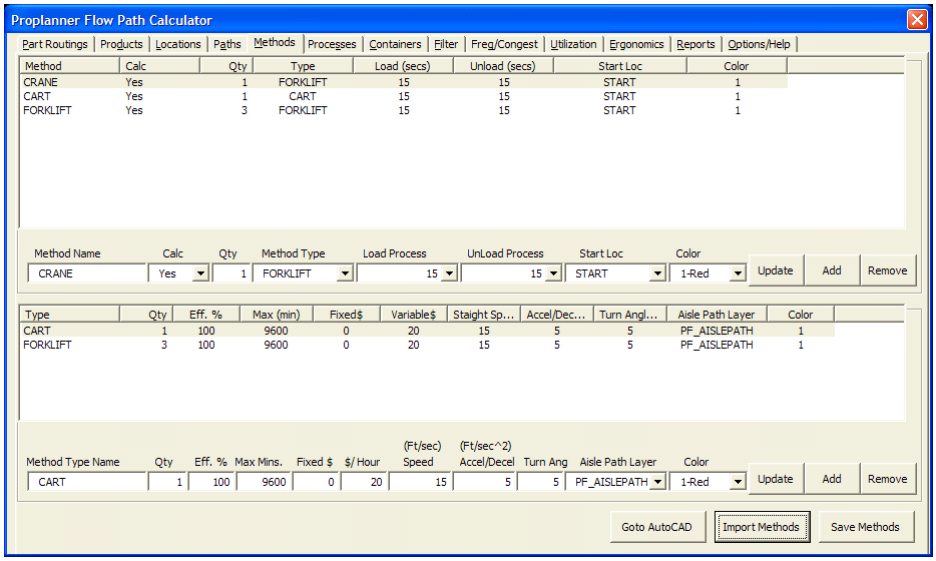
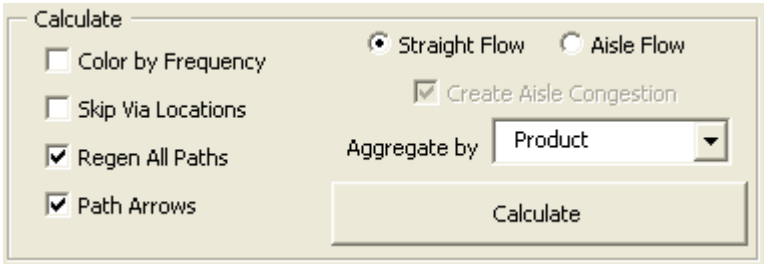

Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Method Calc Qty Type Load (secs) Unload (secs) Start Loc Color
CRANE Yes 1 FORKLIFT 15 15 START 1
CART Yes 1 CART 15 15 START 1
FORKLIFT Yes 3 FORKLIFT 15 15 START 1
Method Name Calc Qty Method Type Load Process UnLoad Process Start Loc Color
CRANE Yes 1 FORKLIFT 15 15 START 1-Red
Update
Add
Remove
Type Qty Eff. % Max (min) Fixed$ Variable$ Staight Sp... Accel/Dec... Turn Angl... Aisle Path Layer Color
CART 1 100 9600 0 20 15 5 5 PF_AISLEPATH 1
FORKLIFT 3 100 9600 0 20 15 5 5 PF_AISLEPATH 1
Method Type Name Qty Eff. % Max Mins. Fixed $ $/ Hour (Ft/sec) Speed (Ft/sec^2) Accel/Decel Turn Ang Aisle Path Layer Color
CART 1 100 9600 0 20 15 5 5 PF_AISLEPATH 1-Red
Update
Add
Remove
Goto AutoCAD
Import Methods
Save Methods

Methods editor

5. Select the *Calculate* button on the Routings Tab, with straight flow option selected.



6. You can now see the straight flow lines.

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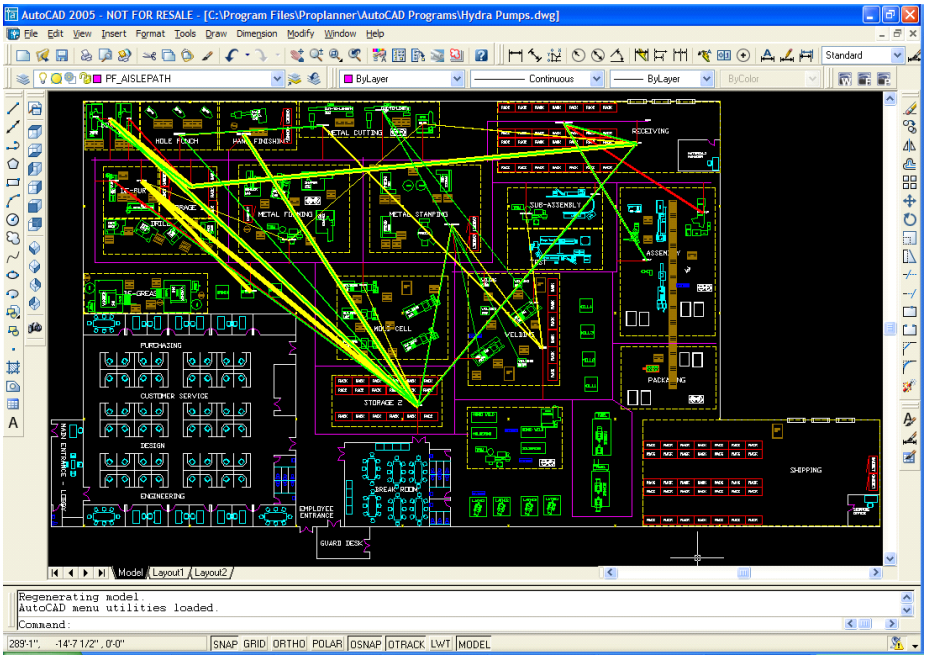
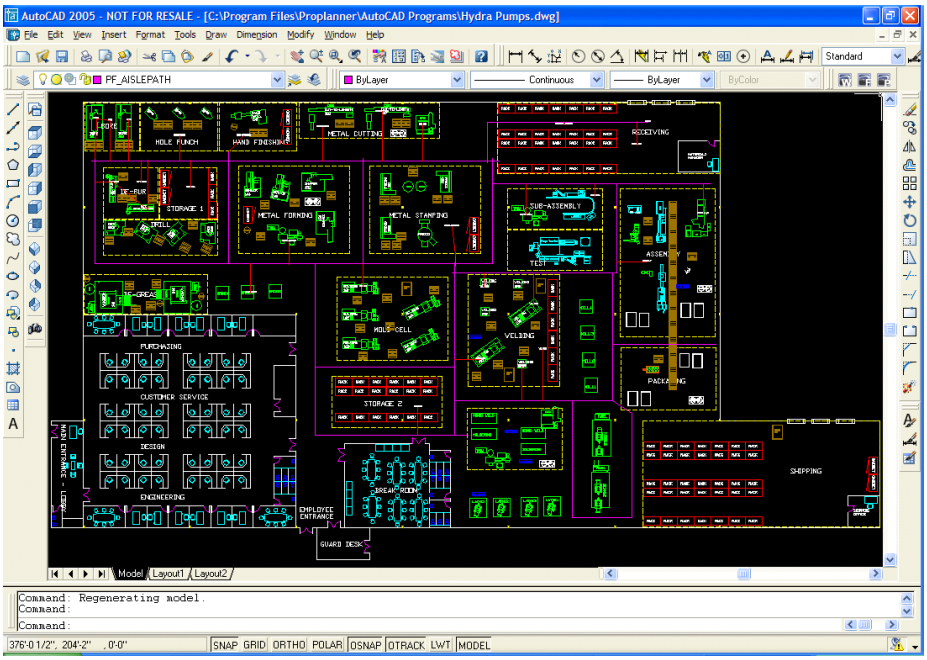

AutoCAD 2005 - NOT FOR RESALE - [C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.dwg]
PF_AISLEPATH
Regenerating model.
AutoCAD menu utilities loaded.
Command:
SNAP GRID ORTHO POLAR OSNAP OTRACK LWT MODEL

Straight flow lines

7. Define your aisle path network by drawing a path line down the aisles of the drawing. This can be seen in the example as the purple lines.


AutoCAD 2005 - NOT FOR RESALE - [C:\Program Files\Proplanner\AutoCAD Programs\Hydra Pumps.dwg]
PF_AISLEPATH
Command: Regenerating model.
Command:
Command:
SNAP GRID ORTHO POLAR OSNAP OTRACK LWT MODEL

Aisle path network

8. Select the *Calculate* button on the Routings Tab, with Aisle flow option selected.

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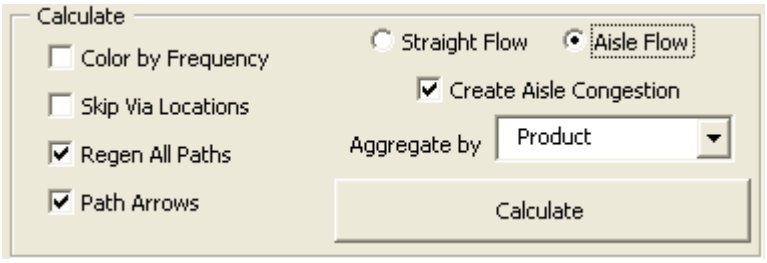
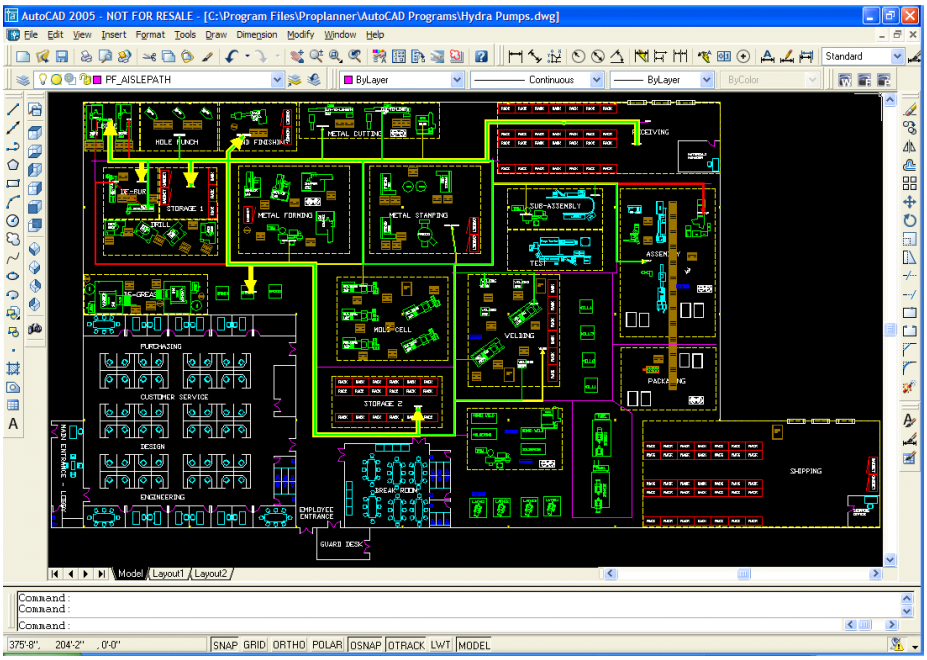


You can now see the aisle flow lines.



Aisle flow lines

8. Observe summary results on the routings tab, path information, or reported information.

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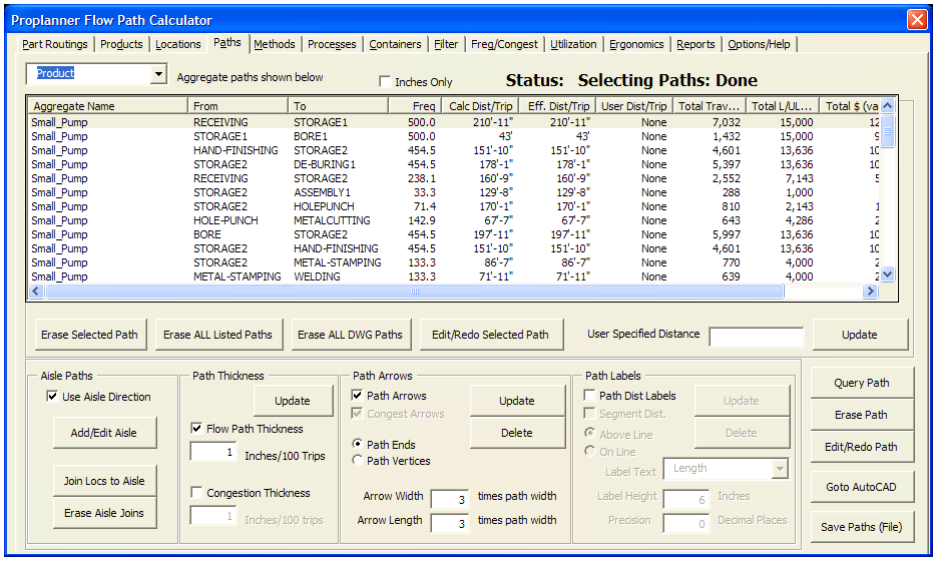
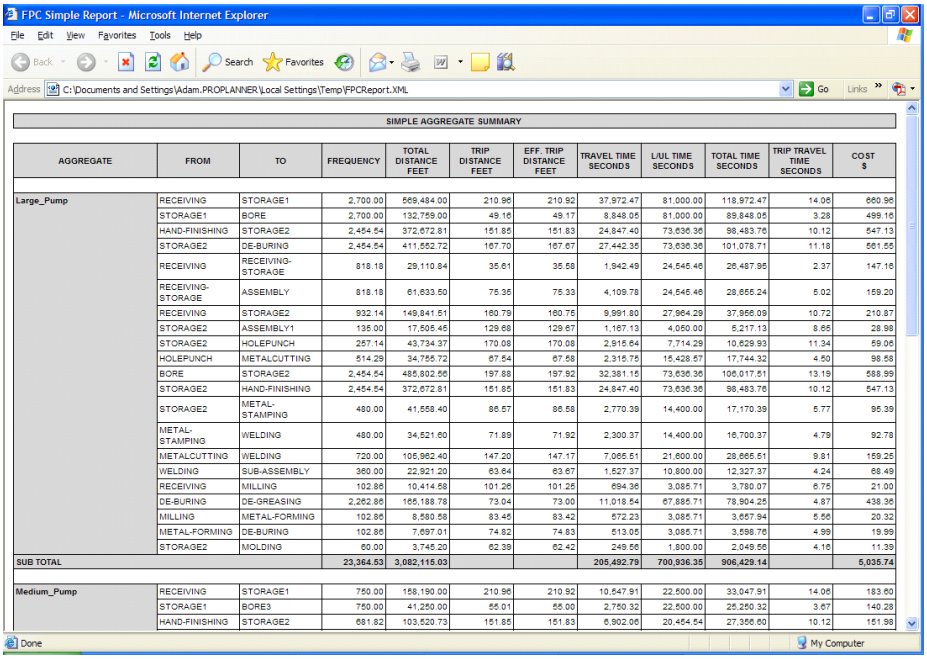

Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump | RECEIVING | STORAGE1 | 500.0 | 210'-11" | 210'-11" | None | 7,032 | 15,000 | 12
Small_Pump | STORAGE1 | BORE1 | 500.0 | 43' | 43' | None | 1,432 | 15,000 | 9
Small_Pump | HAND-FINISHING | STORAGE2 | 454.5 | 151'-10" | 151'-10" | None | 4,601 | 13,636 | 10
Small_Pump | STORAGE2 | DE-BURING1 | 454.5 | 178'-1" | 178'-1" | None | 5,397 | 13,636 | 10
Small_Pump | RECEIVING | STORAGE2 | 238.1 | 160'-9" | 160'-9" | None | 2,552 | 7,143 | 5
Small_Pump | STORAGE2 | ASSEMBLY1 | 33.3 | 129'-8" | 129'-8" | None | 288 | 1,000
Small_Pump | STORAGE2 | HOLEPUNCH | 71.4 | 170'-1" | 170'-1" | None | 810 | 2,143 | 1
Small_Pump | HOLE-PUNCH | METALCUTTING | 142.9 | 67'-7" | 67'-7" | None | 643 | 4,286 | 2
Small_Pump | BORE | STORAGE2 | 454.5 | 197'-11" | 197'-11" | None | 5,997 | 13,636 | 10
Small_Pump | STORAGE2 | HAND-FINISHING | 454.5 | 151'-10" | 151'-10" | None | 4,601 | 13,636 | 10
Small_Pump | STORAGE2 | METAL-STAMPING | 133.3 | 86'-7" | 86'-7" | None | 770 | 4,000 | 2
Small_Pump | METAL-STAMPING | WELDING | 133.3 | 71'-11" | 71'-11" | None | 639 | 4,000 | 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
1
Inches/100 Trips
Congestion Thickness
1
Inches/100 trips
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
3
times path width
Arrow Length
3
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Update
Delete
Label Text
Length
Label Height
6
Inches
Precision
0
Decimal Places
Query Path
Erase Path
Edit/Redo Path
Goto AutoCAD
Save Paths (File)

Path information



Reported information

Aggregation methods of calculation:

1. Product - Accounts for movements belonging to each product. Path colors are dependant on the colors assigned to the product.

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2. Part - Uses quantities of each part as well as product to show results specific to each part name. Colors for the assigned lines are dependant on the colors assigned to the individual parts.

3. Product + Part - Calculates movements for each unique combination of product and part. Colors for the assigned lines are dependant on the colors assigned to the individual parts.

4. Method - Sums the flows for the method, such as each time a specific forklift or cart moves. Colors for the assigned lines are dependant on the colors assigned to the methods.

5. Method Type - Looks at the flow information for general method types such as forklift, cart, or truck. Path colors are dependant on the colors assigned to the method types.

6. From To-Loc - Calculates flow results for each movement between different sets of from and to locations. Colors for the assigned lines are dependant on the colors assigned to the from location's group color.

7. From To-Group - Calculates flow results for movements between each unique combination of from and to groups. Colors for the assigned lines are dependant on the colors assigned to the from location's group color.

8. Container - This calculation takes into account the movements for each individual container type. Colors for the assigned lines are dependant on the colors assigned to the container.

Predetermined time parsing:

This example shows a plain l/ul process as well as the three most popular predetermined time parser codes.

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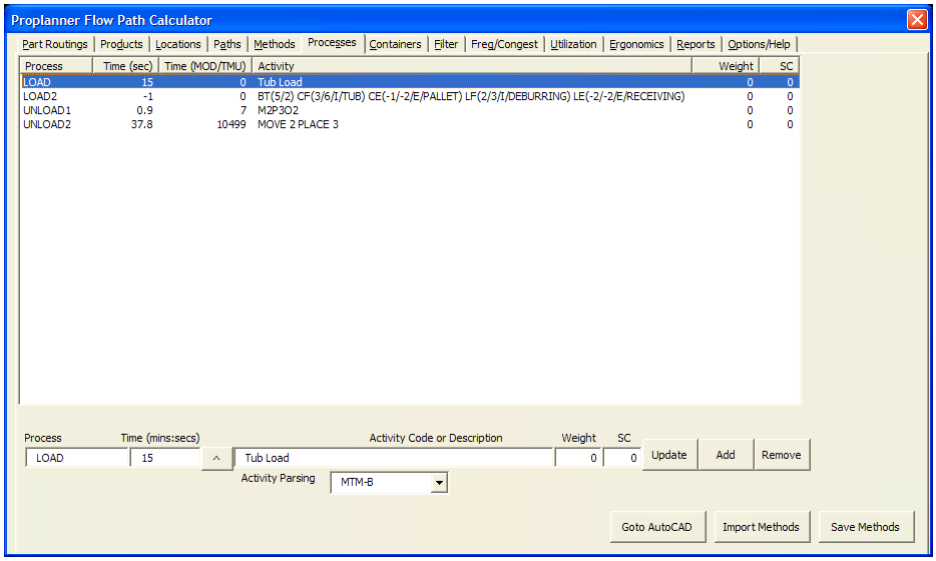
Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Process | Time (sec) | Time (MOD/TMU) | Activity | Weight | SC
LOAD | 15 | 0 | Tub Load | 0 | 0
LOAD2 | -1 | 0 | BT(5/2) CF(3/6/I/TUB) CE(-1/-2/E/PALLET) LF(2/3/I/DEBURRING) LE(-2/-2/E/RECEIVING) | 0 | 0
UNLOAD1 | 0.9 | 7 | M2P3O2 | 0 | 0
UNLOAD2 | 37.8 | 10499 | MOVE 2 PLACE 3 | 0 | 0
Process
Time (mins:secs)
Activity Code or Description
Weight
SC
LOAD
15
Tub Load
0
0
Update
Add
Remove
Activity Parsing
MTM-B
Goto AutoCAD
Import Methods
Save Methods

Example

1. Template - This rule will be applied to each routing using the method that references this "template" load/unload process. This process string allows the user to define a rule for load/unload times that can take into account the from and to locations, container, and if the containers or locations are empty or full for each individual routing. A base time can also be set for the other rules in this process string to add or subtract from, dependant on the container and location status. This example shows a base time that changes if there are additional containers, time added for full containers and locations, and time subtracted for empty containers and locations. This is Load2 in the example.

2. Modapts - Uses Modapts predetermined time codes to parse the activity times. Output can be seen in minutes or seconds. This is Unload1 in the example.

3. MTM-B - Uses MTM-B predetermined time codes to parse the activity times. Output can be seen in minutes or seconds. This is Unload2 in the example.

4. "User Defined" - User can define a list of time codes and their respective values that can be used to parse the activity times.

Congestion diagrams:

1. Load your drawing and make sure that the aisle paths are defined by a line on the appropriate aisle path layer. The aisle path lines can be drawn by going to the paths tab and selecting Add/Edit Aisle Path.

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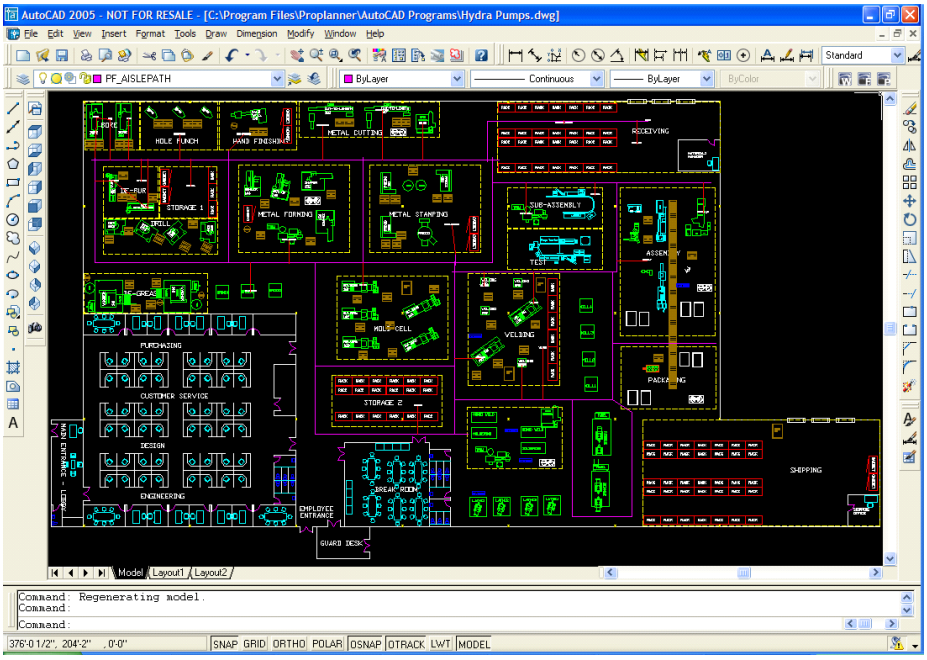
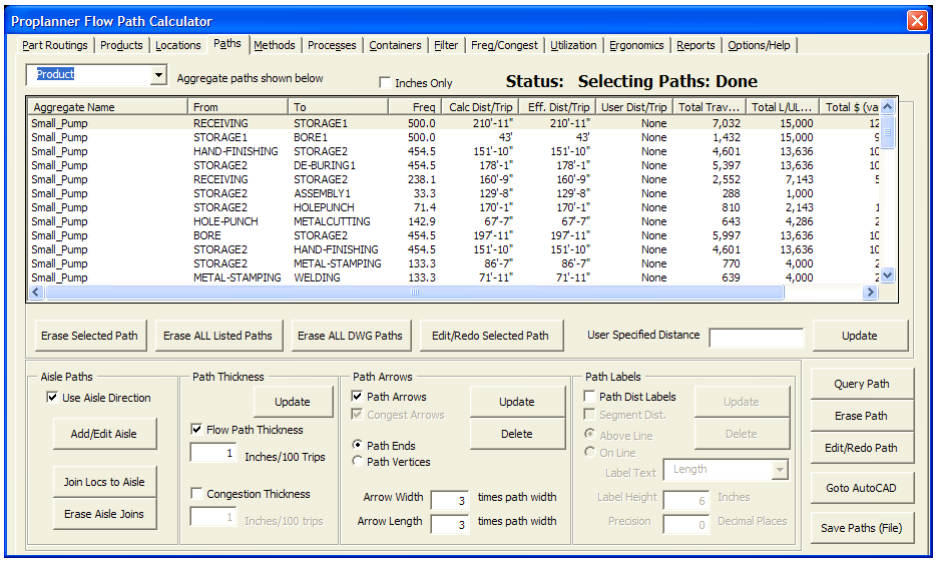


Drawing


Proplanner Flow Path Calculator
Part Routings | Products | Locations | Paths | Methods | Processes | Containers | Filter | Freq/Congest | Utilization | Ergonomics | Reports | Options/Help
Product
Aggregate paths shown below
Inches Only
Status: Selecting Paths: Done
Aggregate Name | From | To | Freq | Calc Dist/Trip | Eff. Dist/Trip | User Dist/Trip | Total Trav... | Total L/UL... | Total $ (va
Small_Pump RECEIVING STORAGE1 500.0 210'-11" 210'-11" None 7,032 15,000 12
Small_Pump STORAGE1 BORE1 500.0 43' 43' None 1,432 15,000 9
Small_Pump HAND-FINISHING STORAGE2 454.5 151'-10" 151'-10" None 4,601 13,636 10
Small_Pump STORAGE2 DE-BURING1 454.5 178'-1" 178'-1" None 5,397 13,636 10
Small_Pump RECEIVING STORAGE2 238.1 160'-9" 160'-9" None 2,552 7,143 5
Small_Pump STORAGE2 ASSEMBLY1 33.3 129'-8" 129'-8" None 288 1,000
Small_Pump STORAGE2 HOLEPUNCH 71.4 170'-1" 170'-1" None 810 2,143 1
Small_Pump HOLE-PUNCH METALCUTTING 142.9 67'-7" 67'-7" None 643 4,286 2
Small_Pump BORE STORAGE2 454.5 197'-11" 197'-11" None 5,997 13,636 10
Small_Pump STORAGE2 HAND-FINISHING 454.5 151'-10" 151'-10" None 4,601 13,636 10
Small_Pump STORAGE2 METAL-STAMPING 133.3 86'-7" 86'-7" None 770 4,000 2
Small_Pump METAL-STAMPING WELDING 133.3 71'-11" 71'-11" None 639 4,000 2
Erase Selected Path
Erase ALL Listed Paths
Erase ALL DWG Paths
Edit/Redo Selected Path
User Specified Distance
Update
Aisle Paths
Use Aisle Direction
Add/Edit Aisle
Join Locs to Aisle
Erase Aisle Joins
Path Thickness
Update
Flow Path Thickness
Inches/100 Trips
Congestion Thickness
Path Arrows
Path Arrows
Congest Arrows
Update
Delete
Path Ends
Path Vertices
Arrow Width
times path width
Arrow Length
times path width
Path Labels
Path Dist Labels
Segment Dist.
Above Line
On Line
Label Text
Length
Label Height
Inches
Precision
Decimal Places
Update
Delete
Query Path
Erase Path
Edit/Redo Path
Goto AutoCAD
Save Paths (File)

Paths tab

2. Once your path lines are there, attach the locations to the aisle so that all parts have a complete aisle path network.

3. Perform an aisle flow analysis by selecting the aisle flow radio button near calculate on the Part Routings tab and then hitting calculate.

4. When this is finished, the Flow Planner will create an alert saying that the congestion diagram has been drawn and will take you to the drawing with the regular

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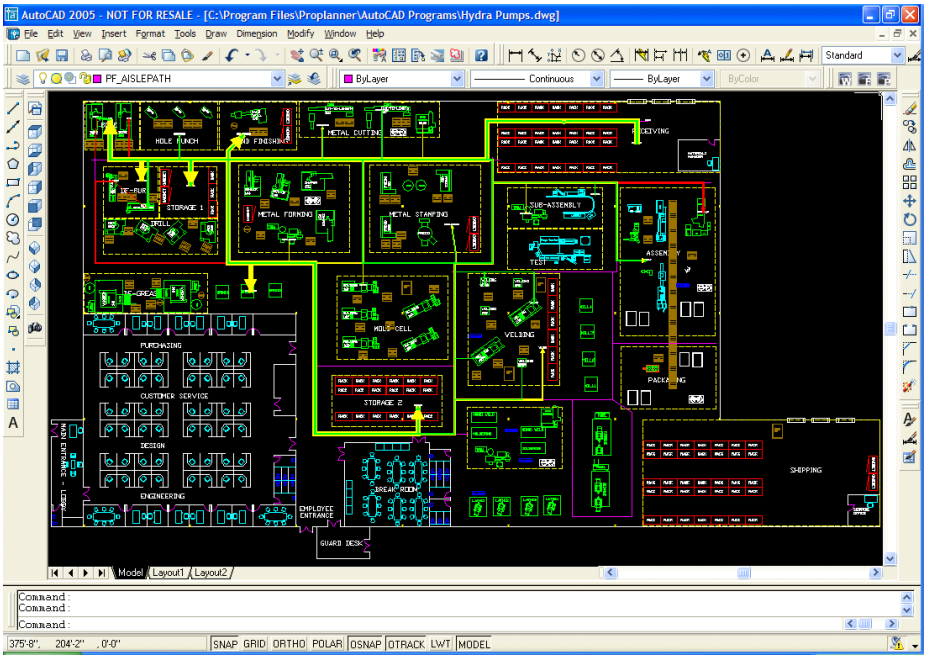
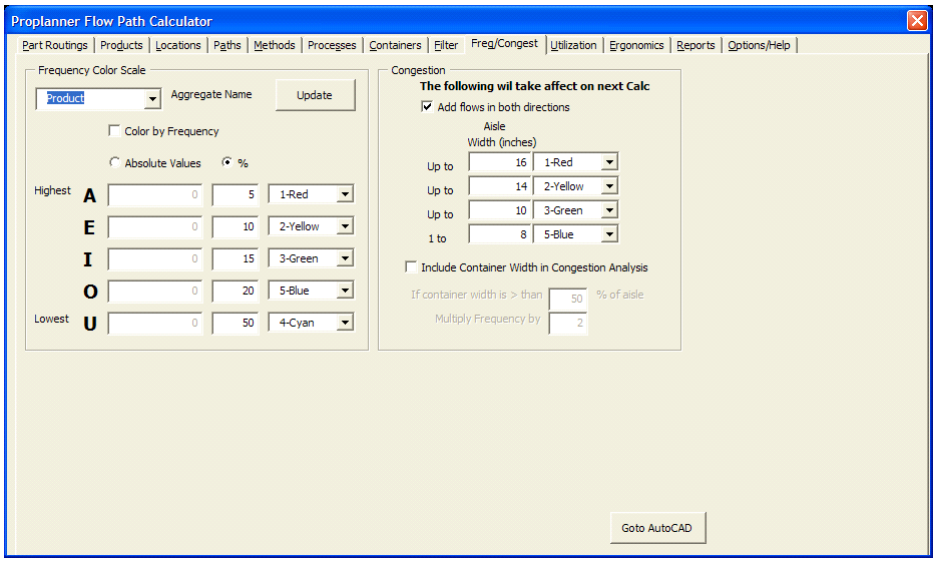
aisle flows.



Aisle flows

5. To see the congestion data that was created, select congestion from Frequency/Congestion tab and hit the update button.



Frequency/Congestion

6. The drawing will now display the flow congestion calculated for each aisle section with the highest areas being shown with the greatest thickness and red or yellow lines. Initially it will be set to a percentage so there will always be paths that

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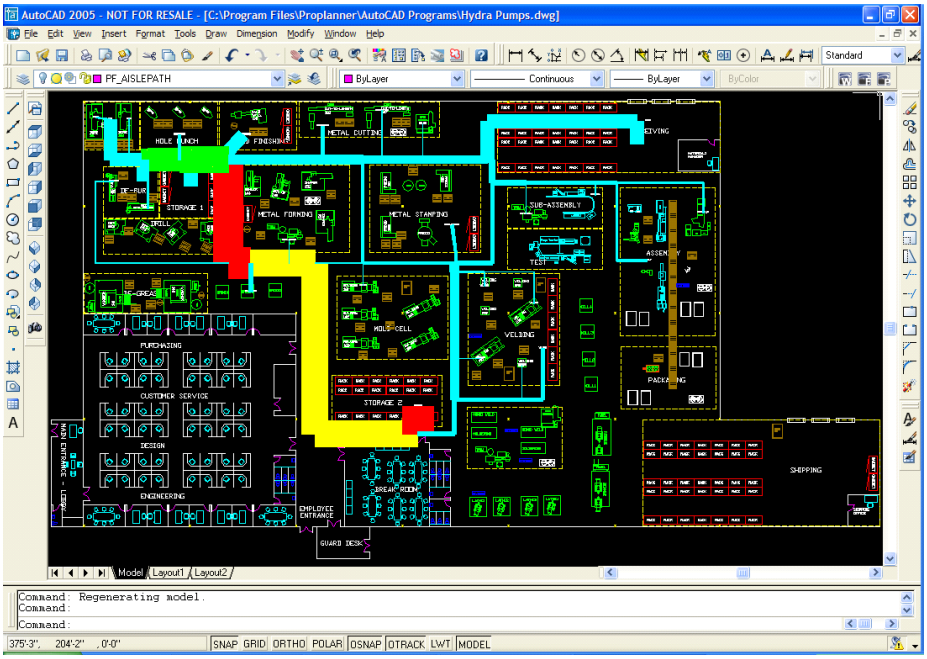
can show up red.



Flow congestion

7. If the user wants to see congestion of specific amounts they can return to the Frequency/Congestion tab and select the Absolute Values radio button and define custom breakpoints for the colors to show up on the drawing. This will help eliminate flows with more specific troublesome congestion numbers.

Filtering:

Filtering helps single out the flow lines that you wish to see without letting other less important lines interfere. The ones filtering removes are still there, just turned off until "Show All Flows" is hit.

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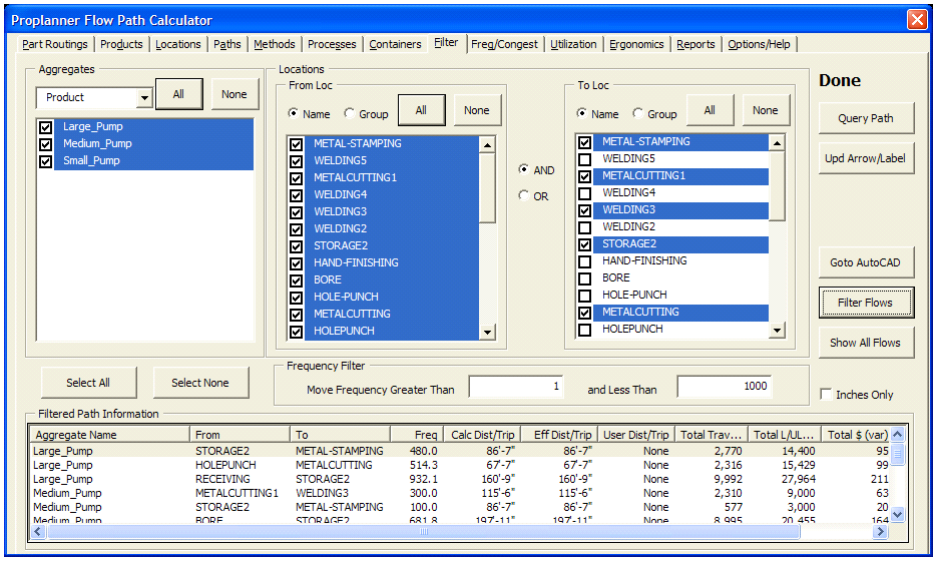

Filtering

1. Aggregate - Selects what aggregate/s to filter. This selection will only show flows for this aggregate. There must have been a calculation done for that aggregation method prior to doing a filter.

2. From and to locs - Selects which locations to show flows between.

3. And vs. Or - The "And" radio button says that both the selected locations or groups for "from and to" must be true for the same path for it to be displayed. The "or" radio button says that either the selected locations or groups for "from and to" must be true for a path for it to be displayed.

4. Frequency - Sets the high and low range a paths frequency must fall between to be displayed after the filter has been applied.

5. Aggregate, from and to locations, and frequency can all be used at the same time to more specifically filter the calculate flow paths.

Utilization charts:

1. Aggregate - Displays a bar chart showing Travel, Load/Unload, Idle, and Over Utilization times for each unique aggregate.

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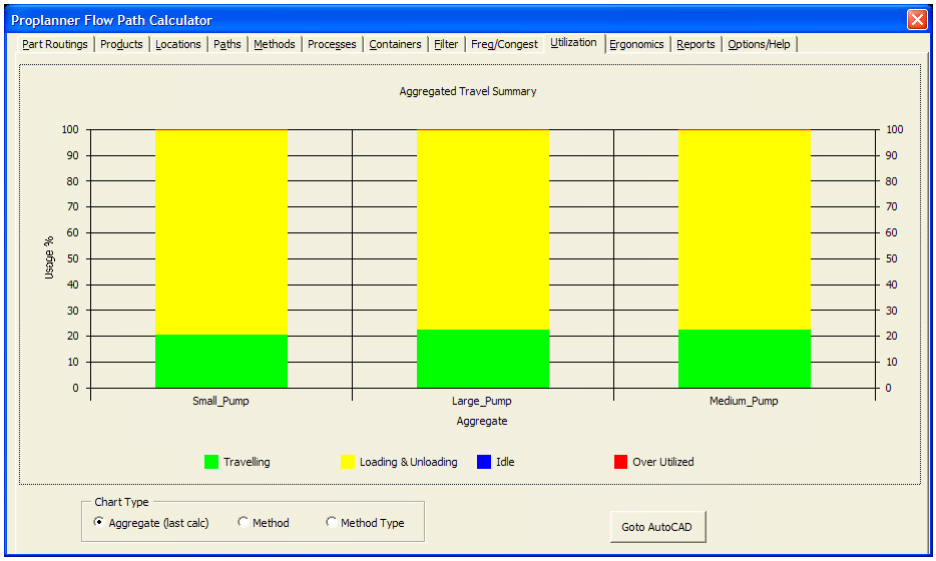
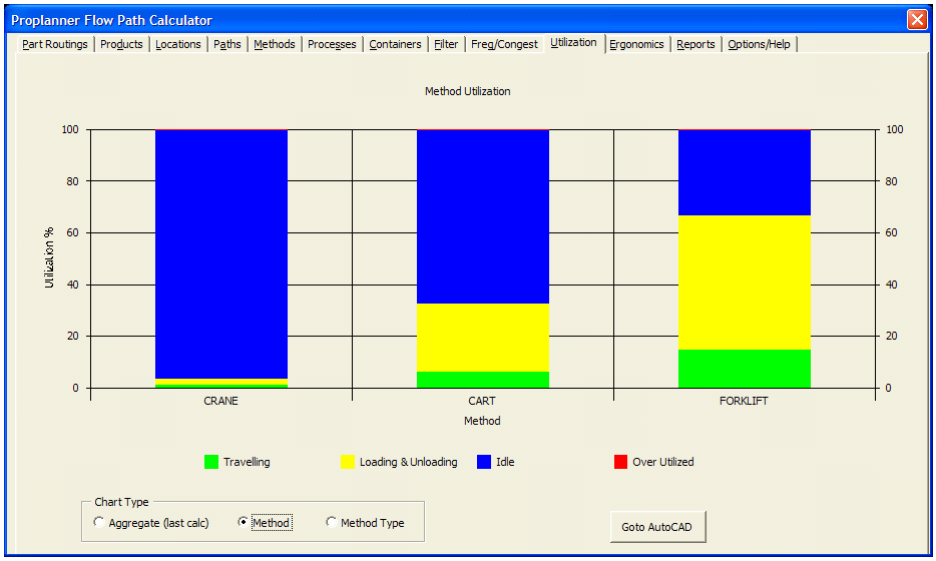


Aggregate

2. Method - Displays a bar chart showing Travel, Load/Unload, Idle, and Over Utilization times for each unique method name, ie. fork1, fork2, fork3.



Method

3. Method type - Displays a bar chart showing Travel, Load/Unload, Idle, and Over Utilization times for each unique method type, ie. forklift, cart, pull_cart.

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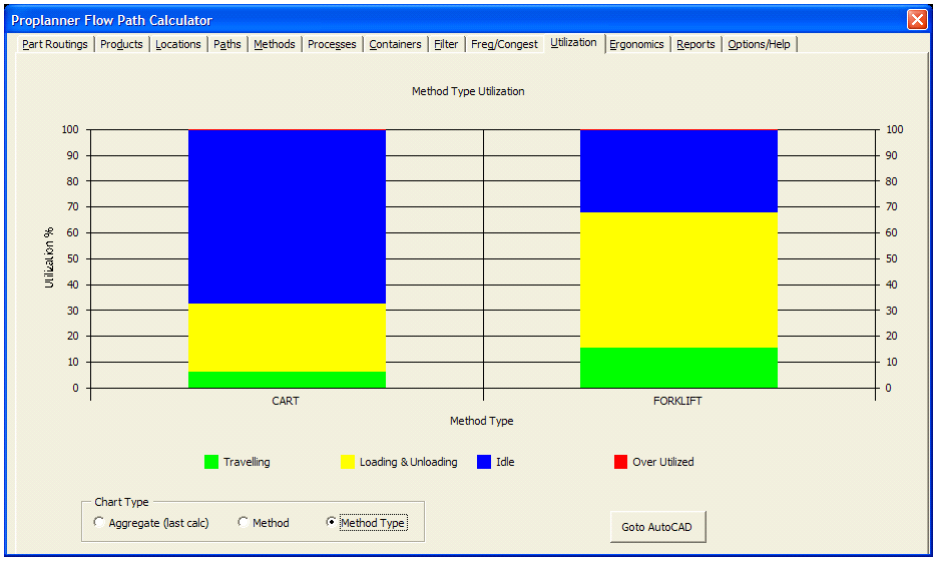
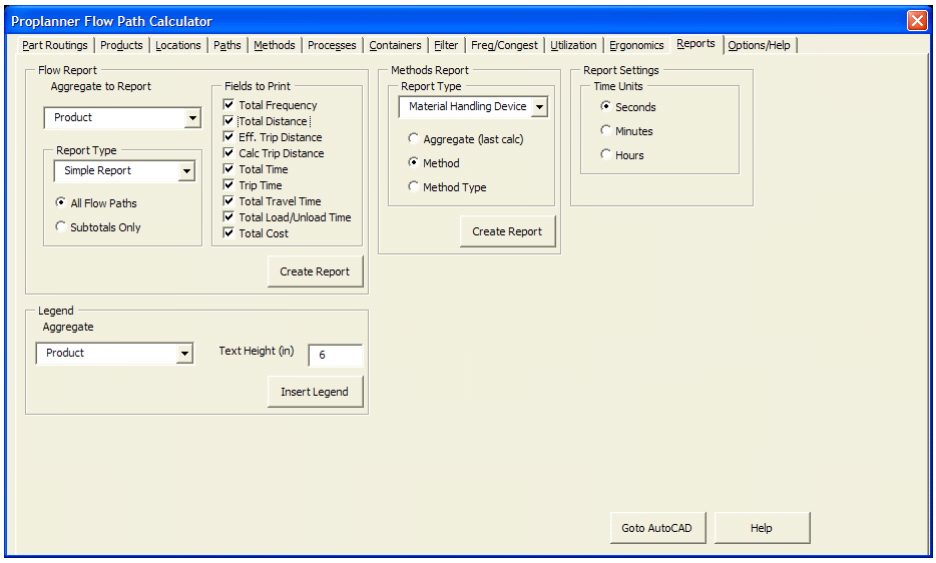


Method type

Advanced reporting:

Reports are generated after a calculation by hitting the "Generate" button next to it's corresponding report type on the Reporting tab. A calculation must have been performed to create the reports.



Reporting tab

1. Simple Report - This report displays all the general path information that was

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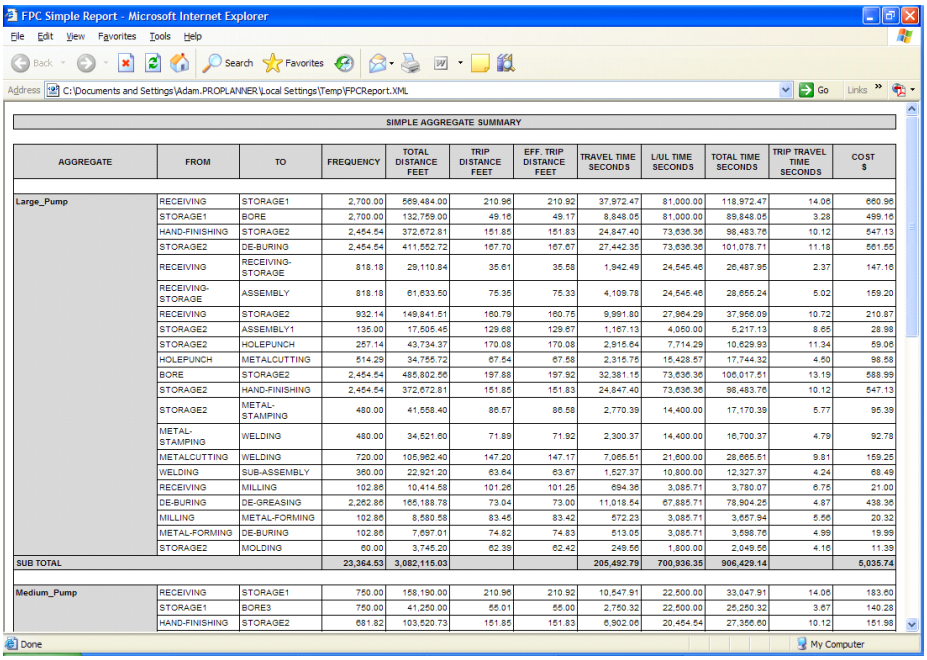
calculated from the drawing in one pre-formatted page that looks like an Excel spreadsheet. The user can shut off selected columns of data by selecting their appropriate checkboxes and re-selecting "Generate"



FPC Simple Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\FPCReport.XML

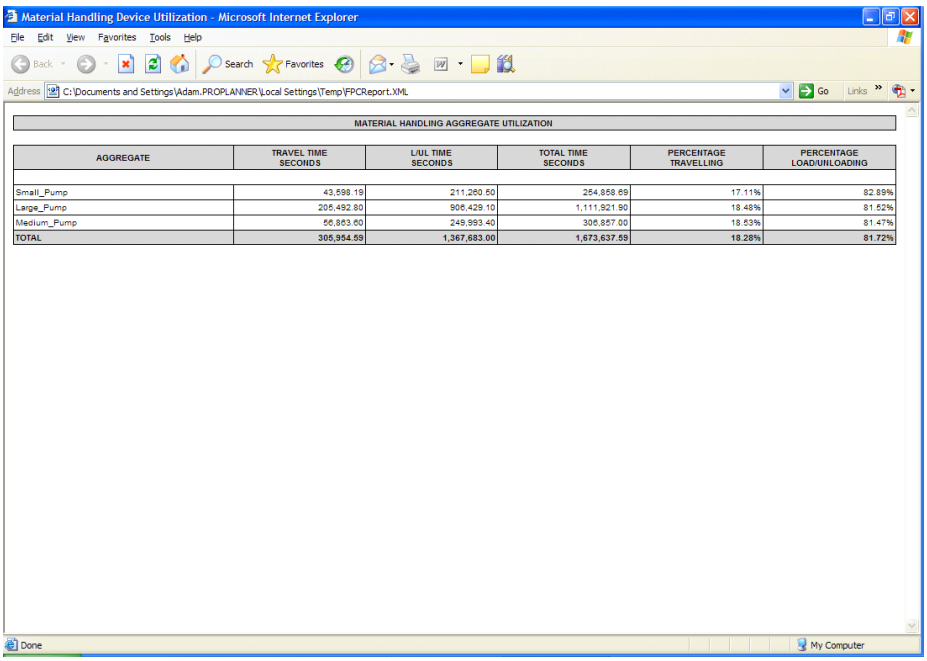
SIMPLE AGGREGATE SUMMARY

AGGREGATE	FROM	TO	FREQUENCY	TOTAL DISTANCE FEET	TRIP DISTANCE FEET	EFF. TRIP DISTANCE FEET	TRAVEL TIME SECONDS	L/UL TIME SECONDS	TOTAL TIME SECONDS	TRIP TRAVEL TIME SECONDS	COST $
Large_Pump	RECEIVING	STORAGE1	2,700.00	569,484.00	210.96	210.92	37,972.47	81,000.00	118,972.47	14.06	660.96
	STORAGE1	BORE	2,700.00	132,759.00	49.16	49.17	8,848.05	81,000.00	89,848.05	3.28	499.16
	HAND-FINISHING	STORAGE2	2,454.54	372,672.81	151.85	151.83	24,847.40	73,636.36	98,483.76	10.12	547.13
	STORAGE2	DE-BURING	2,454.54	411,552.72	167.70	167.67	27,442.35	73,636.36	101,078.71	11.18	561.55
	RECEIVING	RECEIVING-STORAGE	818.18	29,110.84	35.61	35.58	1,942.49	24,545.46	26,487.95	2.37	147.16
	RECEIVING-STORAGE	ASSEMBLY	818.18	61,633.50	75.35	75.33	4,109.78	24,545.46	28,655.24	5.02	159.20
	RECEIVING	STORAGE2	932.14	149,841.51	160.79	160.75	9,991.80	27,964.29	37,956.09	10.72	210.87
	STORAGE2	ASSEMBLY1	135.00	17,505.45	129.68	129.67	1,167.13	4,050.00	5,217.13	8.65	28.98
	STORAGE2	HOLEPUNCH	257.14	43,734.37	170.08	170.08	2,915.64	7,714.29	10,629.93	11.34	59.06
	HOLEPUNCH	METALCUTTING	514.29	34,755.72	67.54	67.58	2,315.75	15,428.57	17,744.32	4.50	98.58
	BORE	STORAGE2	2,454.54	485,802.56	197.88	197.92	32,381.15	73,636.36	106,017.51	13.19	588.99
	STORAGE2	HAND-FINISHING	2,454.54	372,672.81	151.85	151.83	24,847.40	73,636.36	98,483.76	10.12	547.13
	STORAGE2	METAL-STAMPING	480.00	41,558.40	86.57	86.58	2,770.39	14,400.00	17,170.39	5.77	95.39
	METAL-STAMPING	WELDING	480.00	34,621.60	71.89	71.92	2,300.37	14,400.00	16,700.37	4.79	92.78
	METALCUTTING	WELDING	720.00	105,962.40	147.20	147.17	7,065.51	21,600.00	28,665.51	9.81	159.25
	WELDING	SUB-ASSEMBLY	360.00	22,921.20	63.64	63.67	1,527.37	10,800.00	12,327.37	4.24	68.49
	RECEIVING	MILLING	102.86	10,414.58	101.26	101.25	694.36	3,085.71	3,780.07	6.75	21.00
	DE-BURING	DE-GREASING	2,262.86	165,188.78	73.04	73.00	11,018.54	67,885.71	78,904.25	4.87	438.36
	MILLING	METAL-FORMING	102.86	8,580.58	83.45	83.42	572.23	3,085.71	3,657.94	5.56	20.32
	METAL-FORMING	DE-BURING	102.86	7,697.01	74.82	74.83	513.05	3,085.71	3,598.76	4.99	19.99
	STORAGE2	MOLDING	60.00	3,745.20	62.39	62.42	249.56	1,800.00	2,049.56	4.16	11.39
SUB TOTAL			23,364.53	3,082,115.03			205,492.79	700,936.35	906,429.14		5,035.74
Medium_Pump	RECEIVING	STORAGE1	750.00	158,190.00	210.96	210.92	10,547.91	22,500.00	33,047.91	14.06	183.60
	STORAGE1	BORE3	750.00	41,250.00	55.01	55.00	2,750.32	22,500.00	25,250.32	3.67	140.28
	HAND-FINISHING	STORAGE2	681.82	103,520.73	151.85	151.83	6,902.06	20,454.54	27,356.60	10.12	151.98

Done My Computer

Simple Report

2. Aggregate - Displays a detailed report of calculations performed for the methods handling device by Aggregate.



Material Handling Device Utilization - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\FPCReport.XML

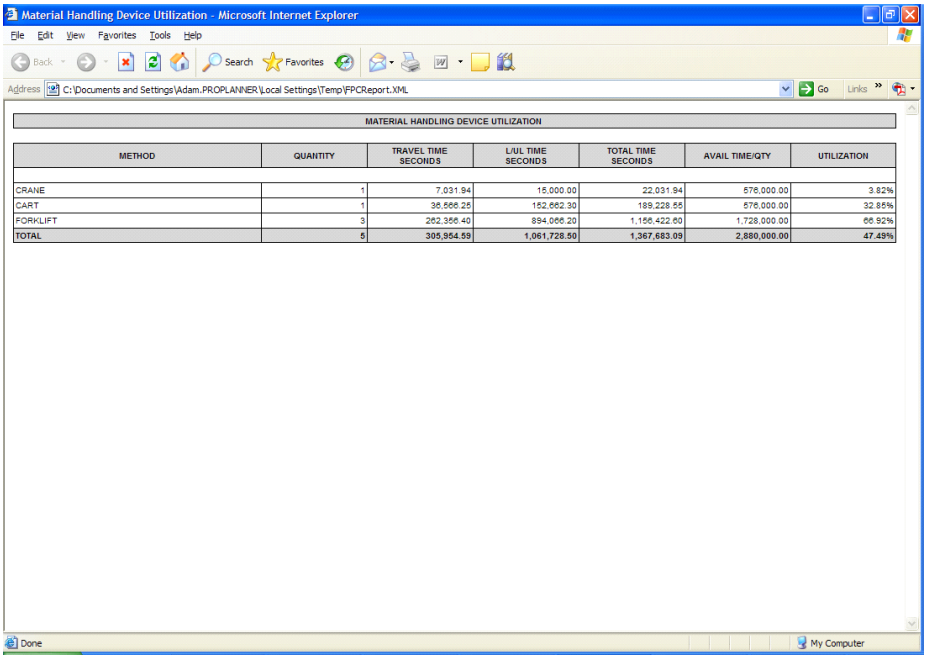
MATERIAL HANDLING AGGREGATE UTILIZATION

AGGREGATE	TRAVEL TIME SECONDS	L/UL TIME SECONDS	TOTAL TIME SECONDS	PERCENTAGE TRAVELLING	PERCENTAGE LOAD/UNLOADING
Small_Pump	43,598.19	211,260.50	254,858.69	17.11%	82.89%
Large_Pump	205,492.80	906,429.10	1,111,921.90	18.48%	81.52%
Medium_Pump	56,863.60	249,993.40	306,857.00	18.53%	81.47%
TOTAL	305,954.59	1,367,683.00	1,673,637.59	18.28%	81.72%

Done My Computer

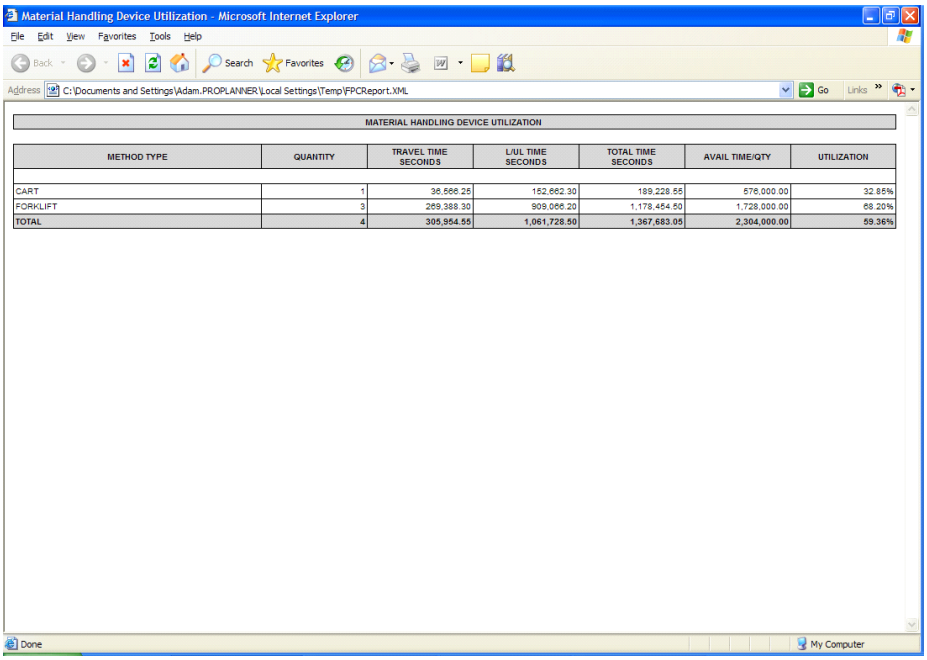
Aggregate

3. Method - Displays a detailed report of calculations performed for the methods handling device by Method.


Material Handling Device Utilization - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\FPCReport.XML
MATERIAL HANDLING DEVICE UTILIZATION
METHOD | QUANTITY | TRAVEL TIME SECONDS | L/UL TIME SECONDS | TOTAL TIME SECONDS | AVAIL TIME/QTY | UTILIZATION
CRANE | 1 | 7,031.94 | 15,000.00 | 22,031.94 | 576,000.00 | 3.82%
CART | 1 | 36,566.25 | 152,662.30 | 189,228.55 | 576,000.00 | 32.85%
FORKLIFT | 3 | 262,356.40 | 894,066.20 | 1,156,422.60 | 1,728,000.00 | 66.92%
TOTAL | 5 | 305,954.59 | 1,061,728.50 | 1,367,683.09 | 2,880,000.00 | 47.49%
Done
My Computer

Method

4. Method type - Displays a detailed report of calculations performed for the methods handling device by Method Type.


Material Handling Device Utilization - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\FPCReport.XML
MATERIAL HANDLING DEVICE UTILIZATION
METHOD TYPE | QUANTITY | TRAVEL TIME SECONDS | L/UL TIME SECONDS | TOTAL TIME SECONDS | AVAIL TIME/QTY | UTILIZATION
CART | 1 | 36,566.25 | 152,662.30 | 189,228.55 | 576,000.00 | 32.85%
FORKLIFT | 3 | 269,388.30 | 909,066.20 | 1,178,454.50 | 1,728,000.00 | 68.20%
TOTAL | 4 | 305,954.55 | 1,061,728.50 | 1,367,683.05 | 2,304,000.00 | 59.36%
Done
My Computer

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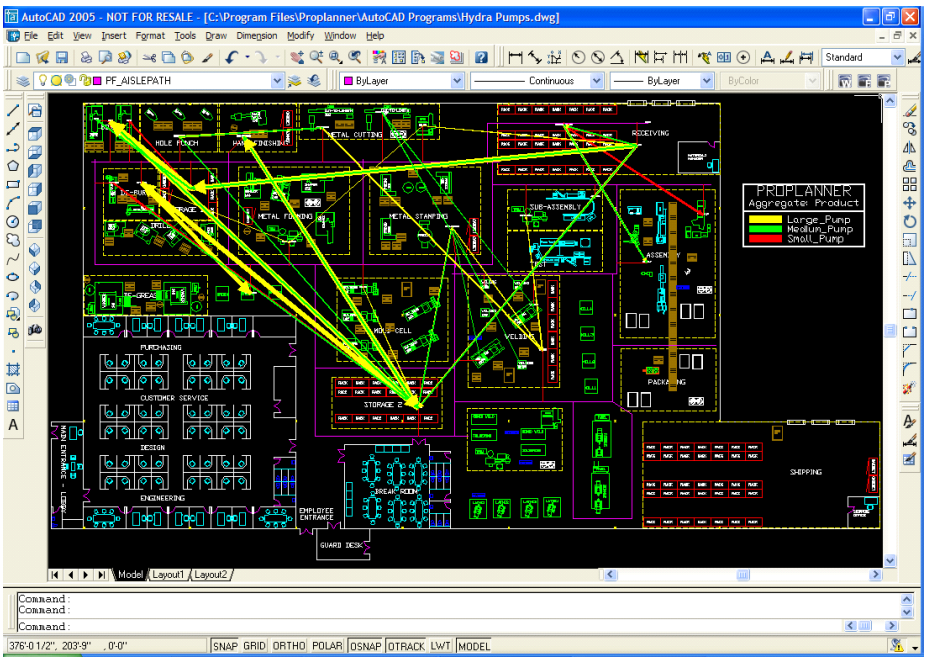
Method type

5. Legend - Besides the reports, the drawing itself can be used as a valuable output tool. On the Reporting tab, a legend can be added to the drawing at any desired scale once the calculations have been performed. This legend displays the line color and name of each unique aggregation line. Once added, the legend will update with new information. The legend must be added for each aggregation the user wishes to display it for however.



Legend

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9 Troubleshoot

Symptom	Possible Causes	Solution

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1. FP will not start up.	Previous version was not uninstalled before this installation.	Uninstall by going to Add/Remove Programs in the control panel, selecting Proplanner AutoCAD Programs and selecting remove. When done, install from the disk.
	If using the stand-alone version that comes with AutoCAD included, “Supplemental” Install was not performed.	This setup file can be found on the install disk in a folder titled “Supplemental”
	Microsoft .NET version 1.1 may not be installed on your computer.	There is a folder titled “Microsoft .NET Install” on the install disk. The setup file is called “dotnetfx.exe” If using an older version of our software, this folder may not be there. In that case, this file can be downloaded and automatically installed by going to Windows Update which can most commonly be reached by clicking a link in the Control Panel or by going to Microsoft.com.
	The menu bar was not installed.	For the 2002 to 2005 versions of AutoCAD, Go to Tools\VBA Manager and load MENULOAD.dvb. Go to Tools\Macros and run the addtoolbar macro. For the 2006 or higher versions of AutoCAD or AutoCAD Engine, type "cuiload" in the command line, then load "PP.cui" from proplanner install fold. More detailed steps can be found in the Install guide on the Proplanner AutoCAD Programs disk.

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2. .csv, .prd, .loc, .mhe files do not open.	Excel by default saved the files as a tab-delimited .csv or an .xls instead of a comma-delimited .csv.	In Excel, select “Save As” and choose .csv (comma-delimited) from the “Save As Type” pull down menu. If dealing with the files which do not end in .csv make sure that there are single quotes around the filename such as ‘expl.loc’ Note that there is also an option to save as .csv(tab-delimited). This is sometimes the default .csv setting within Excel and is what causes this problem most often.
	An extra comma has been placed in the document, making the program think there is an extra column of information.	Open the file in Excel and do a “Find and Replace” or “ctrl + h”. Replace the comma symbol with nothing.
	Files are not sorted alphabetically by Product.	Open the file in Excel and select only the data rows that are not being read correctly, i.e. routing information or the product/part list. Sort the data ascending alphabetically.
	Files may be delimited by “;” instead of a comma.	This is allowed for in the FP and can be corrected by going to the Options/Help tab and changing the “Line Deliminator” in the “Default Settings” from “,” to “;”.

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3. Flow Planner will only open the Hydra Pumps example.	License code and or expiration date has not been entered.	Go to the Options/Help tab and enter the license code exactly as it was emailed to you. It is case sensitive. Also enter the expiration date in the same way, if applicable. The best way is to just copy and paste it from the email you received from Proplanner.
4. License code is rejected.	License code or expiration date is not typed correctly.	Enter the license code exactly as it was emailed to you. It is case sensitive. Also enter the expiration date in the same way, if applicable. The best way is to just copy and paste it from the email you received from Proplanner. Make sure there are no extra spaces in the input box before you paste.

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5. Aisle based flow is being calculated as straight line.	Aisle paths are not actually joined to each other.	In AutoCAD select and make sure all lines are actually touching, making use of the “Snap to Object” Osnap ability which is activated or de activated with F3.
	No aisle path has been defined.	On the Paths tab select “Add/Edit Aisle”. This will take you to AutoCAD and show a modeless window with FP options. Selecting “Add Line” will allow the user to draw the aisle paths just like a regular AutoCAD line. It is recommended to draw as much of the aisle paths at once, without breaking the line, to avoid disconnections and overlaps.
	Locations have not been attached to aisles.	On the Paths tab select “Join Locs to Aisle”.
	Duplicate or overlapping lines exist on the same aisle path, most commonly caused by backtracking while creating the path lines originally.	In AutoCAD look for any obvious overlapping lines and delete or redraw them with the “Add Line” command within the FP modeless window. Next select the lines one by one until you have the whole aisle structure selected. Do not select them all at once because that will include the hidden overlapped lines. Once they are all selected, copy them with base point 0,0 and then delete them. This will show any that were hidden. Delete the lines that were covered up. Right click and insert the copied paths as a block with insert point 0,0. Make sure that the layer is the PP_Aislepath layer when you insert the lines.

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6. Distances and times are drastically incorrect.	Proplanner units differ from drawing units.	Go to the “Options/Help” tab and select the appropriate units, “feet, inches, meters, and millimeters”. If you do not know the drawing units, go to AutoCAD and type “UNITS” into the command line. This will bring up a window where you can get or enter the desired units.
7. Load and Unload times are zero when using Processes.	Methods referenced by routes do not have their Load or Unload times specified to the processes. Also, if you are using the process Templates where the Load and Unload times are dynamically computed by route, then the TIME field on these processes must be set to -1.	Ensure that each Method's Load and Unload time is referencing the correct Process, and that all TEMPLATE-based processes have a -1 specified for their process TIME field.
8. No paths, reports, or output information is shown.	Calculation has not been performed for that aggregation. All this information is stored on the drawing or in the input files once the calculation is run, but this is not automatically created until the first calculation is run or any time there is a change in information.	Make sure the output tab you are on is set to the aggregation type you are wishing to show and that the calculation has been run for that aggregation on the routings tab.
9. Reports are showing no information or format is being distorted when opened.	Operator is using old version of Internet Explorer with which some of the reporting functions are not compatible.	Go to Windows Update, for which a link is usually located in the Control Panel under Settings and update to the latest version.

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10. Path lines are either too small or too large.	These do not automatically scale so must be set manually.	These can be set manually on the Paths tab in the Path Thickness/100 trips. This thickness is scaled in the drawing units.

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10 Appendix

This section deals with the naming conventions, sample routing files and limitations of Flow Planner.

Application Limitations
Application Layers
Input File Format
- Sample Routing File (Hydra Pumps.csv)
- Sample Product/Parts File (Hydra Pumps.prd)
- Sample Methods/Processes/Containers File (Hydra Pumps.mhe)
- Sample Locations/Groups File (Hydra Pumps.loc)
- Sample Paths File (Hydra Pumps.pth)
- Sample Tugger Delivery File (Hydra Pumps Tugger.csv)

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10.1 Application Limitations

These application limitations have been defined in order to limit potentially excessive memory requirements of the application. If these limits prove constraining for certain situations, please contact your Proplanner representative with your specific request.

Maximum Input Routing Lines (file length) = 20,000
Maximum Products (unique names) = 1,000
Maximum Parts (a unique Product – Part pair is one part) = 1,000
Maximum Unique Aggregate Names (per aggregate) = 2,000
Maximum Flow Paths (unique From-To polylines per aggregate) = 20,000
Maximum Locations (unique names) = 2,000
Maximum Nodes (line intersections and endpoints per aisle path layer) = 30,000
Maximum Groups (unique names) = 250
Maximum Methods (unique names) = 250
Maximum Method Types (unique names) = 50
Maximum Processes (unique names) = 100
Maximum Containers (unique names) = 100
Maximum Length of Keyword User-defined time standard = 500 lines

10.2 Application Layers

All Proplanner FP layers begin with **"PF_"** with the exception of the Locations layer which has the **"PP_"** designation which is the same as the Workplace Planner application. The FP application will consistently add and remove text, lines, blocks and polylines from those layers. Proplanner will not alter any graphics on layers other than those beginning with **"PP_"** or **"PF_".**

Note: *aggname* is the aggregate name specified in the routing file (i.e. the Product names or the Part names, or the Method names, etc)

aggtype is the aggregate type. The following options are valid:
- PROD - Product
- PART - Part
- PDPT – Product&Part
- MTHD – Method
- MTYP – Method Type
- FLOC – From-To Location
- FGRP – From-To Group
- CONT - Container

<u>Layer Names</u>
PP_LOCATIONS (contains the location text)
PF_CONG – Contains congestion flow diagram
PF_FPTH-aggtype-*aggname* (contains the flow paths for the specified operator)
PF_AISLEPATH (contains the lines that define the aisles available for the method

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types to use for Aisle Path Flows)
PF_AiSLEPATH-JOIN (contains the lines linking the Location text to the aisle network)

NOTE: AISLEPATH is the default name for the aisle lines in the factory, however you can specify your own layer names (or multiple layers – one for each method type).

10.3 Input file format

The input file is a comma delimited file with a CSV extension. As such, no commas, spaces, tabs, plus signs, forward-slashes or back-slashes are allowed within the text in a field. Proplanner can also read the output files as input files.

NOTE: The input file must be sorted by PRODUCT NAME (column 1). Product names must be contiguously located in the file

Column	Data Value
1	Product name
2	User field (ignored by program but must exist
3	Part name
4	Percent Flow on Part on route (integer from 1 to 100)
5	From Location name
6	Method name
7	Container name
8	Containers per Trip (real number greater than 0)
9	Parts per Container (real number greater than 0)
10	To Location name
11	Via Location name [optional but field must exist]
12	Via Method [only if Via Loc Name specified – field must exist]
13	Via Containers Per Trip (real number greater than 0) [only if via name – field must exist]
14	Description (field must exist and can contain anything)

Sample Routing File (Hydra Pumps.csv)

Sample Product/Parts File (Hydra Pumps.prd)

Sample Methods/Processes/Containers File (Hydra Pumps.mhe)

Sample Locations/Groups File (Hydra Pumps.loc)

Sample Paths File (Hydra Pumps.pth)

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10.3.1 Sample routing file(Hydra Pumps.csv)

Product and part information at bottom is optional. If there is Product and Part information in the CSV file, the PRD file will be ignored but can still be written out to. Dist (in), Freq, L/UL time, Travel Time, Via Dist (in), Via Freq, Via L/UL Time, and Via Travel Time are outputs, added to the CSV after calculations and are not needed for input use.

```
*ROUTINGS (Product, User Defined, Part, Flow%, From, Method, Container, Containers/Trip, Parts/Container, To, Via Loc, Via Method, Via Containers/Trip, Description, Dist (in), Freq, L/UL Time, Travel Time, Via Dist (in), Via Freq, Via L/UL Time, Via Travel Time)

SMALL_PUMP,0,HOUSING,100,RECEIVING,CART,TUB,1,20,BORE1,STORAGE1,CART,1,,2531.4978,500,10,17.5798,515.6086,500,10,3.5806

SMALL_PUMP,1,HOUSING,100,HAND-FINISHING,CART,TUB,1,22,DE-BURING1,STORAGE2,
CART,1,,1822.1433,454.5454,10,12.6538,2137.3606,454.5454,10,14.8428

SMALL_PUMP,1,GASKETS,100,RECEIVING,CART,TUB,2,300,ASSEMBLY1,STORAGE2,CART,2,,1929.4518,33.33333,10,95.7069,1556.1726,33.33333,10,10.8068

SMALL_PUMP,1,PUMP-BASE,100,RECEIVING,CART,TUB,2,35,HOLEPUNCH,STORAGE2,CART,2,,1929.4518,71.42857,10,44.6632,2040.9498,71.42857,10,14.1733

SMALL_PUMP,1,PUMP-BASE,100,HOLEPUNCH,CART,TUB,1,35,METALCUTTING,,,,,810.513,142.8571,10,5.6286,,,,

SMALL_PUMP,1,HOUSING,100,BORE,CART,TUB,1,22,HAND-FINISHING,STORAGE2,CART,1,,2374.6179,454.5454,10,16.4904,1822.1433,454.5454,10,12.6538

SMALL_PUMP,0,STEEL-BLANK,100,RECEIVING,CART,TUB,1,150,METAL-STAMPING,STORAGE2,
CART,1,,1929.4518,133.3333,10,23.9267,1038.896,133.3333,10,7.2146

SMALL_PUMP,1,STEEL-BLANK,100,METAL-STAMPING,CART,TUB,1,150,WELDING,,,,,862.639,133.3333,10,5.9905,,,,

SMALL_PUMP,1,PUMP-BASE,100,METALCUTTING,CART,TUB,1,50,WELDING,,,,,1766.3767,100,10,24.533,,,,

SMALL_PUMP,1,PUMP-BASE,100,METALCUTTING,CART,TUB,1,50,WELDING,,,,,1766.3767,100,10,24.533,,,,

SMALL_PUMP,0,MOTOR2,100,RECEIVING,CART,TUB,1,22,ASSEMBLY_SM,RECEIVING-STORAGE,
CART,1,,427.3479,454.5454,10,5.9354,933.4389,454.5454,10,12.9644

SMALL_PUMP,1,MOTOR,100,RECEIVING,CART,TUB,1,22,ASSEMBLY_SM,RECEIVING-STORAGE,
CART,1,,427.3479,454.5454,10,5.9354,933.4389,454.5454,10,12.9644

Large_Pump,0,HOUSING,100,RECEIVING,FORKLIFT,PALLET,1,20,BORE,STORAGE1,FORKLIFT,1,,2531.4978,2700,22,28.1278,589.8697,2700,22,6.5541

Large_Pump,1,HOUSING,100,HAND-FINISHING,FORKLIFT,PALLET,1,22,DE-BURING,STORAGE2,
FORKLIFT,1,,1822.1433,2454.545,22,20.246,2012.4394,2454.545,22,22.3604

Large_Pump,1,MOTOR,100,RECEIVING,FORKLIFT,PALLET,1,22,ASSEMBLY,RECEIVING-STORAGE,
FORKLIFT,1,,427.3479,818.1818,22,4.7483,904.1515,818.1818,22,10.0461

Large_Pump,1,GASKETS,100,RECEIVING,FORKLIFT,TUB,2,300,ASSEMBLY1,STORAGE2,FORKLIFT,2,,1929.4518,135,22,148.0267,1556.1726,135,22,17.2908

Large_Pump,1,PUMP-BASE,100,RECEIVING,FORKLIFT,PALLET,2,35,HOLEPUNCH,STORAGE2,
FORKLIFT,2,,1929.4518,257.1429,22,77.714,2040.9498,257.1429,22,22.6772

Large_Pump,1,PUMP-BASE,100,HOLEPUNCH,FORKLIFT,PALLET,1,35,METALCUTTING,,,,,810.513,514.2857,22,9.0057,,257.1429,22,

Large_Pump,1,HOUSING,100,BORE,FORKLIFT,PALLET,1,22,HAND-FINISHING,STORAGE2,
FORKLIFT,1,,2374.6179,2454.545,22,26.3846,1822.1433,2454.545,22,20.246

Large_Pump,0,STEEL-BLANK,100,RECEIVING,FORKLIFT,PALLET,1,150,METAL-STAMPING,STORAGE2,
FORKLIFT,1,,1929.4518,480,22,41.6325,1038.896,480,22,11.5433

Large_Pump,1,STEEL-BLANK,100,METAL-STAMPING,FORKLIFT,PALLET,1,150,WELDING,,,,,862.639,480,22,9.5849,,480,22,

Large_Pump,1,PUMP-BASE,100,METALCUTTING,FORKLIFT,PALLET,1,50,WELDING,,,,,1766.3767,360,22,39.2528,,,,

Large_Pump,1,PUMP-BASE,100,METALCUTTING,FORKLIFT,PALLET,1,50,WELDING,,,,,1766.3767,360,22,39.2528,,,,

Large_Pump,1,PUMP-BASE,100,WELDING,FORKLIFT,PALLET,1,50,SUB-ASSEMBLY,,,,,763.6838,360,22,8.4854,,,,

Large_Pump,1,VALVE,100,RECEIVING,FORKLIFT,PALLET,1,175,MILLING,,,,,1215.1264,102.8571,22,13.5014,,,,

Large_Pump,1,HOUSING,100,DE-BURING,FORKLIFT,PALLET,1,25,DE-GREASING,,,,,876.4749,2160,22,10.2024,,,,

Large_Pump,1,VALVE,100,MILLING,FORKLIFT,PALLET,1,175,METAL-FORMING,,,,,1001.3975,102.8571,22,11.1266,,,,

Large_Pump,1,VALVE,100,METAL-FORMING,FORKLIFT,PALLET,1,175,DE-GREASING,DE-BURING,
FORKLIFT,1,,897.8385,102.8571,22,9.976,876.4749,102.8571,22,214.2495

Large_Pump,0,PLASTIC-RAW-MATERIAL,100,RECEIVING,FORKLIFT,PALLET,1,300,MOLDING,STORAGE2,
FORKLIFT,1,,1929.4518,60,22,333.0601,748.6937,60,22,8.3188

Medium_Pump,0,HOUSING,100,RECEIVING,FORKLIFT,PALLET,1,20,BORE3,STORAGE1,FORKLIFT,1,,2531.4978,750,22,28.1278,660.0758,750,22,7.3342

Medium_Pump,1,HOUSING,100,HAND-FINISHING,FORKLIFT,PALLET,1,22,DE-BURING2,STORAGE2,
FORKLIFT,1,,1822.1433,681.8182,22,20.246,1890.5375,681.8182,22,21.006

Medium_Pump,1,MOTOR,100,RECEIVING,FORKLIFT,PALLET,1,22,ASSEMBLY,RECEIVING-STORAGE,
FORKLIFT,1,,427.3479,340.9091,22,4.7483,904.1515,340.9091,22,10.0461

Medium_Pump,1,GASKETS,100,RECEIVING,FORKLIFT,TUB,2,300,ASSEMBLY1,STORAGE2,FORKLIFT,2,,1929.4518,50,22,110.2544,1556.1726,50,22,17.2908

Medium_Pump,1,PUMP-BASE,100,RECEIVING,FORKLIFT,PALLET,2,35,HOLEPUNCH,STORAGE2,
FORKLIFT,2,,1929.4518,107.1429,22,51.452,2040.9498,107.1429,22,22.6772

Medium_Pump,1,PUMP-BASE,100,HOLEPUNCH,FORKLIFT,PALLET,1,35,METALCUTTING,,,,,810.513,214.2857,22,9.0057,,107.1429,22,
```

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```
Medium_Pump,1,HOUSING,100,BORE,FORKLIFT,PALLET,1,22,HAND-FINISHING,STORAGE2,
FORKLIFT,1,,2374.6179,681.8182,22,26.3846,1822.1433,681.8182,22,20.246

Medium_Pump,0,STEEL-BLANK,100,RECEIVING,FORKLIFT,PALLET,1,150,METAL-STAMPING,STORAGE2,
FORKLIFT,1,,1929.4518,100,22,55.1272,1038.896,100,22,11.5433

Medium_Pump,1,STEEL-BLANK,100,METAL-STAMPING,FORKLIFT,PALLET,1,150,WELDING2,,,,,767.1911,100,22,8.5243,,100,22,

Medium_Pump,1,PUMP-BASE,100,METALCUTTING1,FORKLIFT,PALLET,1,50,WELDING3,,,,,1386.1671,150,22,30.8037,,,,

Medium_Pump,1,PUMP-BASE,100,METALCUTTING1,FORKLIFT,PALLET,1,50,WELDING4,,,,,1146.7389,150,22,25.4831,,,,

Medium_Pump,1,STEEL-BLANK,100,METAL-STAMPING,FORKLIFT,PALLET,1,150,WELDING5,,,,,882.5761,100,22,9.8064,,,,

Medium_Pump,1,PUMP-BASE,100,METALCUTTING1,FORKLIFT,PALLET,1,50,WELDING3,,,,,1386.1671,150,22,30.8037,,,,

Medium_Pump,1,PUMP-BASE,100,METALCUTTING1,FORKLIFT,PALLET,1,50,WELDING4,,,,,1146.7389,150,22,25.4831,,,,


*PRODUCTS (Name, Quantity, Color, Calc)

SMALL_PUMP,10000,1,Yes

Large_Pump,18000,2,Yes

Medium_Pump,7500,3,Yes


*PARTS (Product Name, Part Name, Qty Parts/Product, Use%, Days Inventory, Color)

SMALL_PUMP,HOUSING,1,100,1,1

SMALL_PUMP,GASKETS,2,100,1,3

SMALL_PUMP,PUMP-BASE,1,50,1,4

SMALL_PUMP,STEEL-BLANK,2,100,1,6

SMALL_PUMP,MOTOR2,1,100,1,1

SMALL_PUMP,MOTOR,1,100,1,2

Large_Pump,HOUSING,3,100,1,1

Large_Pump,MOTOR,1,100,1,2

Large_Pump,GASKETS,6,75,1,3

Large_Pump,PUMP-BASE,1,100,1,4

Large_Pump,STEEL-BLANK,8,50,1,6

Large_Pump,VALVE,1,100,1,1

Large_Pump,PLASTIC-RAW-MATERIAL,1,100,1,1

Medium_Pump,HOUSING,2,100,1,1

Medium_Pump,MOTOR,1,100,1,2

Medium_Pump,GASKETS,4,100,1,3

Medium_Pump,PUMP-BASE,1,100,1,4

Medium_Pump,STEEL-BLANK,4,50,1,6
```

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10.3.2 Sample product/parts file (Hydra Pumps.prd)

```
*PRODUCTS
Small_Pump,10000,1,Yes
Large_Pump,18000,2,Yes
Medium_Pump,7500,3,Yes

*PARTS
Small_Pump,HOUSING,1,100,1,1
Small_Pump,GASKETS,2,100,1,3
Small_Pump,PUMP-BASE,1,50,1,4
Small_Pump,STEEL-BLANK,2,100,1,6
Small_Pump,MOTOR2,1,100,1,1
Small_Pump,MOTOR,1,100,1,2
Large_Pump,HOUSING,3,100,1,1
Large_Pump,MOTOR,1,100,1,2
Large_Pump,GASKETS,6,75,1,3
Large_Pump,PUMP-BASE,1,100,1,4
Large_Pump,STEEL-BLANK,8,50,1,6
Large_Pump,VALVE,1,100,1,1
Large_Pump,PLASTIC-RAW-MATERIAL,1,100,1,1
Medium_Pump,HOUSING,2,100,1,1
Medium_Pump,MOTOR,1,100,1,2
Medium_Pump,GASKETS,4,100,1,3
Medium_Pump,PUMP-BASE,1,100,1,4
Medium_Pump,STEEL-BLANK,4,50,1,6
```

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10.3.3 Sample Methods/processes/containers file (Hydra Pumps.mhe)

```
*METHODS
"CART","1","HAND","5","5","100","RECEIVING","1","Yes"
"FORKLIFT","1","FORK","10","10","100","RECEIVING","2","Yes"

*METHODTYPES
"HAND","80","0","20","15","5","5","PF_AISLEPATH","1","115200","1"
"FORK","50","3000","40","15","5","5","PF_AISLEPATH","2","115200","1"

*CONTAINERS
"TUB","1","1","1","1","1","1"
"PALLET","1","1","1","1","1","2"

*PROCESSES
"LOAD","10","0","None","0","0"
"UNLOAD","12","0","None","0","0"
```

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10.3.4 Sample Locations/Groups file (Hydra Pumps.loc)

```
*LOCATIONS (NAME X Y GROUP)
RECEIVING,0,0,UNASSIGNED
BORE1,0,0,MACHINING
STORAGE1,0,0,STORAGE
HAND-FINISHING,0,0,ASSEMBLY
DE-BURING1,0,0,MACHINING
STORAGE2,0,0,STORAGE
ASSEMBLY1,0,0,ASSEMBLY
HOLEPUNCH,0,0,STAMPING
METALCUTTING,0,0,MACHINING
BORE,0,0,MACHINING
METAL-STAMPING,0,0,STAMPING
WELDING,0,0,WELDING
ASSEMBLY_SM,0,0,ASSEMBLY
RECEIVING-STORAGE,0,0,STORAGE
DE-BURING,0,0,MACHINING
ASSEMBLY,0,0,ASSEMBLY
SUB-ASSEMBLY,0,0,ASSEMBLY
MILLING,0,0,MACHINING
DE-GREASING,0,0,UNASSIGNED
METAL-FORMING,0,0,STAMPING
MOLDING,0,0,UNASSIGNED
BORE3,0,0,MACHINING
DE-BURING2,0,0,MACHINING
WELDING2,0,0,WELDING
METALCUTTING1,0,0,MACHINING
WELDING3,0,0,WELDING
WELDING4,0,0,WELDING
WELDING5,0,0,WELDING

*GROUPS (NAME COLOR  X Y)
UNASSIGNED,1,0,0
WELDING,2,0,0
MACHINING,3,0,0
STAMPING,4,0,0
ASSEMBLY,6,0,0
STORAGE,1,0,0

*DRAWING EXTENTS (MINX MINY MAXX MAXY) in INCHES
-222,-180,4500.5,2955.8183
```

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10.3.5 Sample paths file (Hydra Pumps.pth)

```
Flow Path Type: Product
FLOW PATHS (PATHNUM, AGGREGATE, FROM LOC, TO LOC, CALC DISTANCE, FREQUENCY, USER
DISTANCE, L/UL TIME, TRAVEL TIME, TOTAL COST, METHOD TYPE NAME)
1,Medium_Pump,METAL-STAMPING,WELDING5,1803.35,100,None,2000,2003.72,44.49,FORK
2,Medium_Pump,METALCUTTING1,WELDING4,3386,300,None,6000,11286.67,192.07,FORK
3,Medium_Pump,METALCUTTING1,WELDING3,3765,300,None,6000,12550,206.11,FORK
4,Medium_Pump,METAL-STAMPING,WELDING2,906.35,100,None,2000,1007.05,33.41,FORK
5,Medium_Pump,STORAGE2,METAL-STAMPING,2711.35,100,None,2000,3012.61,55.7,FORK
6,Medium_Pump,STORAGE2,HAND-FINISHING,3489.94,681.82,None,13636.36,26438.91,445.28,
FORK
7,Medium_Pump,BORE,STORAGE2,3838,681.82,None,13636.36,29075.76,474.58,FORK
8,Medium_Pump,HOLEPUNCH,METALCUTTING,1138,214.29,None,4285.71,2709.52,77.72,FORK
9,Medium_Pump,STORAGE2,HOLEPUNCH,3732,107.14,None,2142.86,4442.86,73.17,FORK
10,Medium_Pump,STORAGE2,ASSEMBLY1,4370.97,50,None,1000,2428.32,38.09,FORK
11,Medium_Pump,RECEIVING,STORAGE2,4450,257.14,None,5142.86,12714.29,198.41,FORK
12,Medium_Pump,RECEIVING-STORAGE,ASSEMBLY,2138,340.91,None,6818.18,8098.49,165.74,
FORK
13,Medium_Pump,RECEIVING,RECEIVING-STORAGE,554,340.91,None,6818.18,2098.48,99.07,
FORK
14,Medium_Pump,STORAGE2,DE-BURING2,3757.69,681.82,None,13636.36,28467.37,467.82,
FORK
15,Medium_Pump,HAND-FINISHING,STORAGE2,2949.94,681.82,None,13636.36,22348,399.83,
FORK
16,Medium_Pump,STORAGE1,BORE3,2672.91,750,None,15000,22274.22,414.16,FORK
17,Medium_Pump,RECEIVING,STORAGE1,3017,750,None,15000,25141.67,446.02,FORK
18,Large_Pump,STORAGE2,MOLDING,2100,60,None,1200,1400,28.89,FORK
19,Large_Pump,METAL-FORMING,DE-BURING,1666,102.86,None,2057.14,1904,44.01,FORK
20,Large_Pump,MILLING,METAL-FORMING,1666,102.86,None,2057.14,1904,44.01,FORK
21,Large_Pump,DE-BURING,DE-GREASING,1484,1542.86,None,30857.14,25440,625.52,FORK
22,Large_Pump,RECEIVING,MILLING,1758,102.86,None,2057.14,2009.14,45.18,FORK
23,Large_Pump,WELDING,SUB-ASSEMBLY,4108.97,360,None,7200,16435.88,262.62,FORK
24,Large_Pump,METALCUTTING,WELDING,3619,720,None,14400,28952,481.69,FORK
25,Large_Pump,METAL-STAMPING,WELDING,1780.35,240,None,4800,4747.59,106.08,FORK
26,Large_Pump,STORAGE2,METAL-STAMPING,2711.35,240,None,4800,7230.26,133.67,FORK
27,Large_Pump,STORAGE2,HAND-FINISH,3489.94,1636.36,None,32727.27,63453.4,1068.67,
FORK
28,Large_Pump,BORE,STORAGE2,3838,1636.36,None,32727.27,69781.84,1138.99,FORK
29,Large_Pump,HOLEPUNCH,METALCUTTING,1138,514.29,None,10285.71,6502.86,186.54,FORK
30,Large_Pump,STORAGE2,HOLEPUNCH,3732,257.14,None,5142.86,10662.86,175.62,FORK
31,Large_Pump,STORAGE2,ASSEMBLY1,4370.97,120,None,2400,5827.96,91.42,FORK
32,Large_Pump,RECEIVING,STORAGE2,4450,677.14,None,13542.86,33480.95,522.49,FORK
33,Large_Pump,RECEIVING-STORA,ASSEMBLY,2138,818.18,None,16363.64,19436.36,397.78,
FORK
34,Large_Pump,RECEIVING,RECEIVING-STORAGE,554,818.18,None,16363.64,5036.36,237.78,
FORK
35,Large_Pump,STORAGE2,DE-BURING,3928,1636.36,None,32727.27,71418.2,1157.17,FORK
36,Large_Pump,HAND-FINISH,STORAGE2,2949.94,1636.36,None,32727.27,53635.22,959.58,
FORK
37,Large_Pump,STORAGE1,BORE,2593,1800,None,36000,51860,976.22,FORK
38,Large_Pump,RECEIVING,STORAGE1,3017,1800,None,36000,60340,1070.44,FORK
39,Small_Pump,RECEIVING-STORA,ASSEMBLY_SM,2186,909.09,None,9090.91,13800.5,127.17,
HAND
40,Small_Pump,RECEIVING,RECEIVING-STORAGE,554,909.09,None,9090.91,3497.47,69.94,
HAND
41,Small_Pump,METALCUTTING,WELDING,3619,400,None,4000,10052.78,78.07,HAND
42,Small_Pump,METAL-STAMPING,WELDING,1780.35,133.33,None,1333.33,1648.47,16.57,HAND
43,Small_Pump,STORAGE2,METAL-STAMPING,2711.35,133.33,None,1333.33,2510.51,21.35,
HAND
44,Small_Pump,STORAGE2,HAND-FINISHING,3489.94,909.09,None,9090.91,22032.43,172.91,
HAND
45,Small_Pump,BORE,STORAGE2,3838,909.09,None,9090.91,24229.8,185.12,HAND
46,Small_Pump,HOLEPUNCH,METALCUTTING,1138,285.71,None,2857.14,2257.94,28.42,HAND
47,Small_Pump,STORAGE2,HOLEPUNCH,3732,142.86,None,1428.57,3702.38,28.51,HAND
48,Small_Pump,STORAGE2,ASSEMBLY1,4370.97,66.67,None,666.67,2023.6,14.95,HAND
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49,Small_Pump,RECEIVING,STORAGE2,4450,342.86,None,3428.57,10595.24,77.91,HAND
50,Small_Pump,STORAGE2,DE-BURING1,3510,909.09,None,9090.91,22159.09,173.61,HAND
51,Small_Pump,HAND-FINISHING,STORAGE2,2949.94,909.09,None,9090.91,18623.34,153.97,
HAND
52,Small_Pump,STORAGE1,BORE1,729,1000,None,10000,5062.5,83.68,HAND
53,Small_Pump,RECEIVING,STORAGE1,3017,1000,None,10000,20951.39,171.95,HAND


DRAWING EXTENTS (MINX, MINY, MAXX, MAXY) in INCHES
-180,-180,4500.5,2412

PATH VERTICES (PATHNUM, #VERTICES, node1, node2, node3, node4 ...)
1,11,1,2,3,4,5,6,7,8,9,10,11
2,11,12,13,14,15,16,17,7,6,5,18,19
3,12,12,13,14,15,16,17,7,6,5,18,20,21
4,7,1,2,3,4,5,6,22
5,11,23,24,25,17,7,6,5,4,3,2,1
6,11,23,24,25,17,16,15,14,26,27,28,29
7,13,30,31,32,33,34,35,36,37,16,17,25,24,23
8,6,38,39,40,27,26,41
9,12,23,24,25,17,16,15,14,26,27,40,39,38
10,17,23,24,42,8,9,43,44,45,46,47,48,49,50,51,52,53,54
11,14,55,56,57,58,59,60,13,14,15,16,17,25,24,23
12,11,61,57,58,59,62,63,64,53,52,51,65
13,4,55,56,57,61
14,12,23,24,25,17,16,37,36,35,34,33,66,67
15,11,29,28,27,35,36,37,16,17,25,24,23
16,10,68,40,27,35,34,33,32,31,30,69
17,12,55,56,57,58,59,60,13,14,26,27,40,68
18,8,23,24,25,17,16,15,70,71
19,9,72,37,36,35,27,40,39,73,74
20,8,75,60,13,14,15,16,37,72
21,8,74,73,39,40,27,35,36,76
22,7,55,56,57,58,59,60,75
23,16,77,10,9,43,44,45,46,47,48,49,50,51,52,53,64,78
24,11,41,26,14,15,16,17,7,8,9,10,77
25,11,1,2,3,4,5,6,7,8,9,10,77
26,11,23,24,25,17,7,6,5,4,3,2,1
27,11,23,24,25,17,16,15,14,26,27,28,29
28,13,30,31,32,33,34,35,36,37,16,17,25,24,23
29,6,38,39,40,27,26,41
30,12,23,24,25,17,16,15,14,26,27,40,39,38
31,17,23,24,42,8,9,43,44,45,46,47,48,49,50,51,52,53,54
32,14,55,56,57,58,59,60,13,14,15,16,17,25,24,23
33,11,61,57,58,59,62,63,64,53,52,51,65
34,4,55,56,57,61
35,13,23,24,25,17,16,15,14,26,27,40,39,73,74
36,11,29,28,27,35,36,37,16,17,25,24,23
37,9,68,40,27,35,34,33,32,31,30
38,12,55,56,57,58,59,60,13,14,26,27,40,68
39,11,61,57,58,59,62,63,64,53,52,79,80
40,4,55,56,57,61
41,11,41,26,14,15,16,17,7,8,9,10,77
42,11,1,2,3,4,5,6,7,8,9,10,77
43,11,23,24,25,17,7,6,5,4,3,2,1
44,11,23,24,25,17,16,15,14,26,27,28,29
45,13,30,31,32,33,34,35,36,37,16,17,25,24,23
46,6,38,39,40,27,26,41
47,12,23,24,25,17,16,15,14,26,27,40,39,38
48,17,23,24,42,8,9,43,44,45,46,47,48,49,50,51,52,53,54
49,14,55,56,57,58,59,60,13,14,15,16,17,25,24,23
50,11,23,24,25,17,16,37,36,35,34,33,66
51,11,29,28,27,35,36,37,16,17,25,24,23
52,6,68,40,39,73,81,82
53,12,55,56,57,58,59,60,13,14,26,27,40,68
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NODE LOCATIONS (NODENUM Xloc Yloc)
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10.3.6 Sample Tugger Delivery file (Hydra Pumps Tugger.csv)

*ID,Part,Container,ContQty,From,Stage,To,ETD,Direction,Load,Unload
Consumable1,111456,BOX35,4,RECEIVING,STORAGE1,HOLEPUNCH,7.1,1,,
Consumable2,111847,BOX36,4,RECEIVING,STORAGE1,DE-BURING,7.2,1,,
Consumable3,111332,CRATE2,6,RECEIVING,STORAGE1,BORE,7.3,1,,
Consumable4,111445,CRATE2,6,RECEIVING,STORAGE1,DE-BURING1,7.4,1,,
Casting1,235448,FLAT,5,RECEIVING,STORAGE1,DE-GREASING,7.5,1,,
Casting2,235449,FLAT,5,RECEIVING,STORAGE1,METAL-FORMING,7.6,1,,
Casting3,235450,FLAT,5,RECEIVING,STORAGE1,METAL-STAMPING,7.7,1,,
Casting4,235988,FLAT,5,RECEIVING,STORAGE1,METALCUTTING,7.8,1,,
Casting5,235989,FLAT,5,RECEIVING,STORAGE1,HAND-FINISHING,7.9,1,,
Subassembly1,851001,CRATE2,10,RECEIVING2,STORAGE2,WELDING,7.1,1,,
Subassembly2,851002,CRATE3,6,RECEIVING2,STORAGE2,WELDING3,7.2,1,,
Subassembly3,851003,CRATE4,8,RECEIVING2,STORAGE2,WELDING4,7.3,1,,
Subassembly4,851004,CRATE5,4,RECEIVING2,STORAGE2,SUB-ASSEMBLY,7.4,1,,
Subassembly5,851005,FLAT,2,RECEIVING2,STORAGE2,ASSEMBLY1,7.5,1,,
Subassembly6,851006,FLAT,2,RECEIVING2,STORAGE2,ASSEMBLY,7.6,1,,
Part-1234,999126,BOX42,1,RECEIVING2,STORAGE2,WELDING2,7.7,1

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